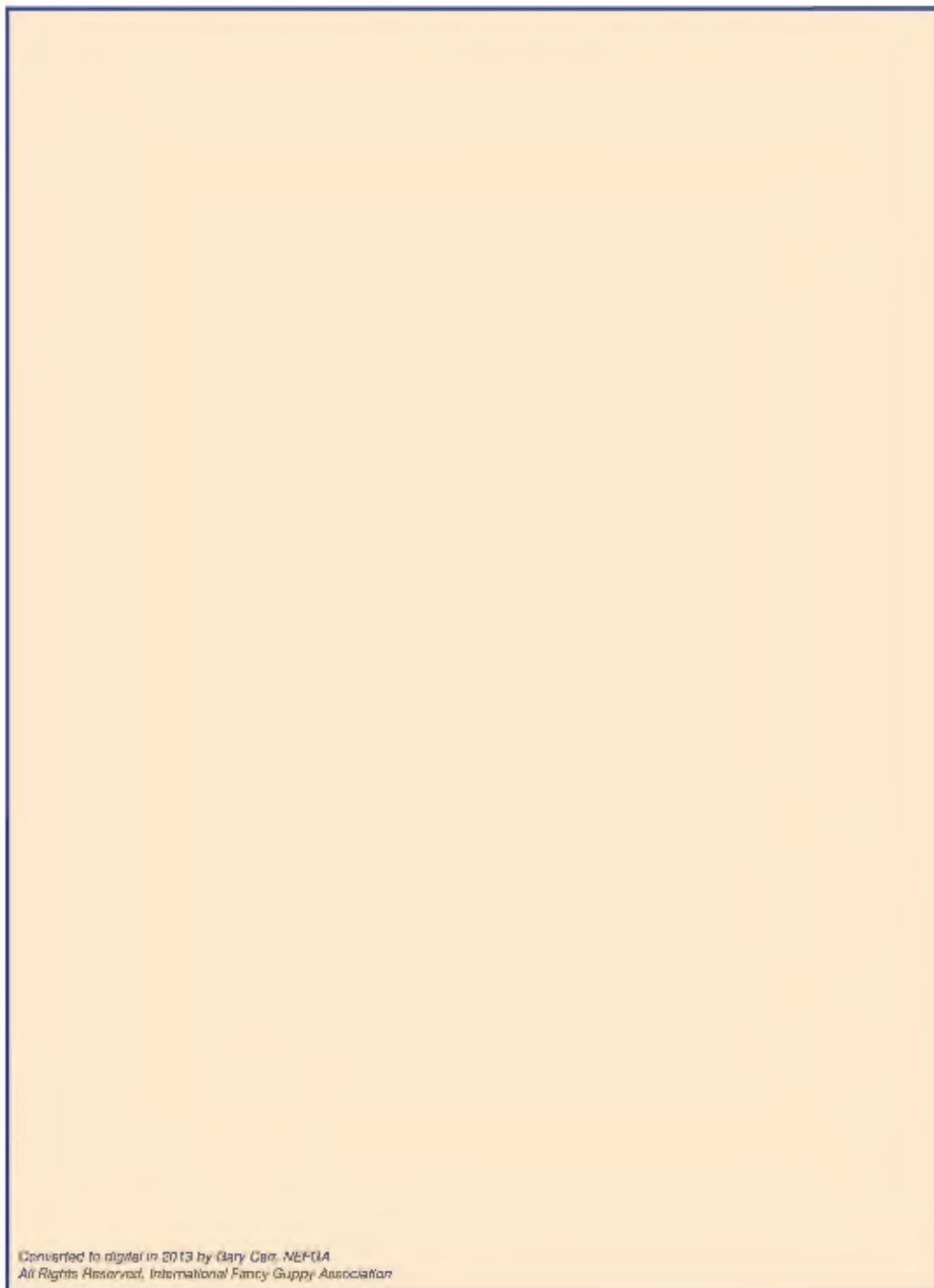




*The  
International  
Fancy Guppy  
Association*



**IFGA EXTRACTS  
BOOK FOUR**



## IFGA EXTRACTS

### Book Four

## FORWARD

The Extract Series Volumes One, Two, Three, Four, and Five is dedicated to the International I would imagine that you are surprised that there is 5 Volumes. Frankly I am too! Originally I wanted to buy Extract one, but they were not available. One day I got a call from a member that had a photo ready copy of Extracts One. I took this to the printer and had copies made. After reading it I realized the articles were very good.

At one of the G.A.M. Meetings I discussed with Dick Wagner about using His back issues of the I.F.G.A. Bulletin to make Extract Two. Well Dick pulled out two large boxes of back issues. I thought I would read the articles for my own personal enjoyment and pick out only the real outstanding articles for reprint. After spending a couple month's reading the articles I found 900 pages of good articles. I divided the articles into sections according to subjects. So each Extract has different subject material and goes into great detail.

My real motivation to complete the Extracts, was the fact that all the people that bought Extracts One wanted to know if there would be Extracts Two and I said "Yes in the fall of 1988, so sure enough in the fall of 1988 I started to get checks for Extracts Two. So I guess a promise is a promise. The Extracts Series is available at \$15.00 per copy post paid, Canada \$16.00, but please indicate which volume you wish to order. Make all checks payable to The Guppy Associates of Milwaukee, Bill Klein, 739 S. 122 Street, West Allis, Wisconsin, 52214, 414-771-5935.

Enjoy the articles, and whenever you have a problem with your guppies go back to the Extract and read them again. You will be surprised how each time you read them you will be looking for solutions to new problems.



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## EXPERIMENT WITH VITAMINS

by Jim Woodruff

**THE FISH:** I used for this experiment 3/4 black guppy fry, 20 to a tank.

**THE TANKS:** I used two 10-gallon tanks containing gravel, plants, filtration, temperature and lights all the same. Tank A - control; Tank B - experiment.

**THE FOOD:** I tried to feed three times a day. Twice with live baby brine shrimp and once with Tetramin.

**THE VITAMINS:** I won't give the brand name but will list the vitamins, minerals and amounts:

Iron (Ferris Orthophosphate)	40 mg
Vitamin E	20 I.U.
Vitamin C (Ascorbic Acid)	100 mg
Calcium (Di-Cal -Phos)	100 mg
Phosphorous (Di-Cal -Phos)	75 mg
Vitamin B6 (Pyridoxine HCl)	2 mg
Vitamin B-12 (Cyanocobalamin)	5 mg
Copper (as Copper Sulfate)	20 mg
Biotin	30 mg.
Manganese (as Manganese Sulfate)	10 mg
Vitamin A (Palmitate)	10,000 USP units

In preparing the vitamins to feed, I crushed one at a time. I fed a pinch once a day in the morning.

## COMPARISON:

For the first four weeks both batches of fry grew about the same.

At six weeks, Tank B fry were larger and further developed. Tank A were still growing steadily.

At eight weeks, Tank B fry were about the size of the parents. Tank A fry were about three quarters grown.

At ten weeks, Tank B fry were larger than the parents. Tank A were about the size of the parents.

At twelve weeks, Tank B fry were larger than the parents by a quarter of an inch. Tank A fry were the size of the parents.

At fourteen weeks, Tank B fry were still growing fast. A male that died measured 1-7/8 inches from nose to base of tail. It was about 1/2 inch larger than daddy. Tank A fry were still growing, but slower. They are about 1/8 inch larger than the parents.

At sixteen weeks Tank B fry are still growing slowly. They are about twice the size of the parents. They are about 3/4 again the size of their brothers and sisters in Tank A.

At twenty weeks, Tank B fry are still gaining in size and number. A Couple of females delivered about 40 fry. Tank A have quit growing in size but are growing in number...about 80 fry. The new babies are about the same size in both tanks.

At twenty-four weeks, Tank B fish are still growing. They are about twice the size of Tank A fish.

At twenty-eight weeks, Tank B fish still seem to be growing. The males are huge and look fabulous.

At one year, Tank A fish started dying and stopped reproducing. Tank B fish slowed down on productivity and some males have died. The young from Tank A grew to the size of their parents. The young in Tank B are a little larger than their aunts and uncles in A. At twenty eight weeks, I stopped feeding vitamins.

(reprinted from Valley Aquarium Review, April-May 1973. Originally from ("NWOAS Fish Net")

## **"B" COMPLEX VITAMINS... HOW IMPORTANT ARE THEY TO FISH?**

by Joseph L. Busso

Knowledge of the part that vitamins play in fish nutrition is based on the data which has been accumulated by the game fish hatcheries run by state and federal conservation departments and by individual hobbyists and researchers who have experimented with vitamins and their relationship with fish.

The natural foods consumed by fish contain all the vitamins they normally need. When fish are placed in the aquarium and fed artificial foods, and only a few specific varieties of live foods, it is rather difficult for them to acquire the necessary vitamins and a sufficient amount of them in order to maintain and sustain proper and normal metabolic functions.

A vitamin deficiency is easily diagnosed when one of its symptoms appear in a fish. If two or more of these symptoms are found in the same aquarium, one may conclude that his fish have a vitamin deficiency. It is generally found that the absence of vitamins A, D, E and K in the diet of fish do not have a great effect upon them. However, the fact that fish have a definite need for certain members of the water soluble vitamin B complex has been proven in test after test. If a fish's diet lacks these vitamins, numerous body symptoms and a reduction in weight will occur.

One of the most common vitamin deficiencies which occur among aquarium fish is a lack of B-1 (Thiamine). When there is a deficiency of thiamine, the fish tend to have a poor appetite and feed only on specific live foods. Even their eating of these foods may not be caused by hunger but rather because of a natural reflex known as "momentary feeding act". Along with this apathetic mood towards food, a fish will also develop muscular and nervous malfunctions which develop into convulsions and in some cases may even lead to death.

So important is Vitamin B-2 (Riboflavin) to the process of fish growth, that a number of manufacturers add riboflavin to the dried food they produce.

Hobbyists are usually quick to blame poor water conditions for causing parasitic and bacterial skin infections. It was fairly recently that researchers found vitamins play an important part in a fish's natural defense against disease. Without the numerous B complex vitamins known as biotin and pantothenic acid, the process of mucus production decreases or may stop completely. Without a sheet of mucus covering its scales, a fish is susceptible to many bacterial, fungus and parasitic infections.

Several disadvantages have been noted to occur when fish are kept under ultraviolet fluorescent fixtures. One set-back is that U.V. disorganizes the basic process of cellular division and causes many mutations as exposure to radioactive isotope carbon, 14. But, minor doses of U.V. should not normally impair the health of mature fish. When fish become ill or die after mild exposure to U.V., their loss, may again be attributed to a vitamin B deficiency. A lack of niacin will increase a fish's sensitivity to U.V. light and cause it to literally get a case of "sunburn". When a fish becomes "sunburned", it has two alternatives; either hide in the shade and starve, or eat and get a stroke.

If your fish get sick for no apparent reason and their symptoms match these in the following chart, they may have a vitamin deficiency.

SYMPTOMS	DUE TO LACK OF
Growth reduction	Choline
Growth reduction and sluggishness	B-12 Cobalamin, Folic or Inositol
Growth reduction; eyes become opaque	B-2 Riboflavin
Nervous disorder and sluggishness	B-6 Pyridoxine
Nervous disorder, muscular disorders, convulsions, poor appetite	B-1 Thiamine
Skin diseases and sluggishness	Pantothenic acid
Skin diseases and convulsions	Biotin
"Sunburn" due to U.V.	Niacin

A dose of the necessary vitamin may be administered to fish by either of two methods:

1. Dissolve the vitamin directly into the water.
2. Prepare a paste food (Gordon's formula or any beef heart paste) and add to it one half of the prescribed human dose of the specific vitamin needed.

If this food mixture is fed two or three times a week, the deficiency should disappear and the fish will regain their normally healthy conditions.

**CAUTION:** Do not feed your fish any human multiple vitamin. When a fish has too much of a vitamin it does not normally need, it may develop what is known as "Hypervitaminosis".

(reprinted from Horsforth Aquarium Society)

## **VITAMINS**

by James P. Morang

When an adequate amount of any one vitamin is not present, a specific pathologic condition or deficiency disease occurs. In order to give fish the proper vitamins, you must know the source of these vitamins.

**Vitamin A** occurs only in animal products such as butter, eggs and fish liver oils, but plants contain a yellowish substance called carotene or provitamin A, which is easily changed into Vitamin A in animal cells. Vitamin A itself is fat-soluble and can be stored in the fish's body. This vitamin is necessary for the maintenance of the epithelial cells of the scales, eyes, digestive and respiratory tracts (gills, pharynx, nostrils). In Vitamin A deficiency, these cells become flat, brittle and less resistant to infection than normal. This vitamin is called an "anti-infection vitamin". Also, vitamin A is necessary for the maintenance of normal nerve tissue, for reproduction, and for the growth of bones in the development of larger strains.

**Vitamin B Complex** is extracted from liver, yeast or rice hulls. This substance has nine other minerals with specific biologic effects, which have been separated, but are all grouped together as members of the B Complex, not because they are similar chemically or in their effects, but because they tend to occur together and when separated, a loss of vitamin quality occurs.

**Vitamin B-1 (Thiamine)** is a white, crystalline material found in small quantities in a wide variety of foods. Yeast, liver, pork and whole grain cereals are the best sources of all the Vitamin B complex. This

vitamin is stored in the body to a great extent. Evidences of a deficiency appear within a few weeks. The function of thiamine in the body of a fish is to form the active part, or "coenzyme", of certain enzymes involved in the metabolism of carbohydrates, particularly of pyruvic acid. When a thiamine deficiency interferes with carbohydrate metabolism, a number of characteristic symptoms appear. In mild deficiencies there is loss of appetite, weakness, and muscular action stoppage in the caudal fin. In more marked deficiencies there is an up and down movement of the fish and a spinal cord bending about the area of the dorsal fin. The symptoms disappear very slowly when given thiamine in their food.

**Vitamin B-2 (Riboflavin)** is a yellow substance found in both plant and animal tissue. It occurs most abundantly in: yeast, liver, wheat germ, meat (beef heart), eggs and cheese. Riboflavin is necessary for the metabolism of glucose, amino acids and certain cellular oxidation processes. A deficiency of riboflavin is marked by the appearance of open cracks on the fish's body. These later become infected and cause death. A deficiency also stunts growth. In experimental riboflavin deficiencies in fish, there is a failure of growth, loss of some scales, inflammation of the eyes (pop eyes), and finally death.

**Vitamin B-6 (Pyridoxine)** is necessary in the diet of fish. It occurs in meat, eggs, nuts, whole grain cereals and beans. In a clear cut deficiency of pyridoxine in fish, a slow reaction will occur. As pyridoxine is involved in the metabolism of amino acids, a deficiency causes failure of growth and the fish becomes anemic and has atrophied lymph tissues that lower resistance to infection. To prevent this, more protein in the diet and more pyridoxine is needed to stimulate growth for larger fish.

**Vitamin B-12 (Folic acid)**, Choline, Inositol and Para-aminobenzoic acid, Folic Acid and Vitamin B-12 are necessary to prevent anemia and are used in conjunction with liver extract in developing larger fish by higher metabolism. They are active as coenzymes in the metabolism of certain substances involved in the synthesis of amino acids and nucleic acids in reproduction and formation of red blood cells.

Choline is a growth factor, the absence of which causes hemorrhages in the kidneys and a bone deformity. It is important in the metabolism of fats and proteins not as a coenzyme, as many other B Complex vitamins are, but as a source of methyl groups used in building up certain essential substances.

Inositol and para-aminobenzoic acid have been reported as important in preventing tail splitting, and in pelvic fin, dorsal fin and caudal fin to prevent color loss and short growth.

**Vitamin C** can be found in a combination of vegetables in the diet. It plays some part in cellular oxidations, particularly the oxidation of the amino acid, tyrosine. It is necessary for the maintenance of normal connective tissue. In its absence the capillaries become exceedingly fragile and easily ruptured, resulting in hemorrhages under the skin. The development of the spinal cord is abnormal, so the fish is stunted. Lack of this vitamin can also be seen by bruised scales and general weakness of the fish in swimming.

**Vitamin D**, also called **calciferol**, is fat-soluble. It is unique in that it can be made in the body of the fish under the influence of sunlight, or artificial light. Vitamin D is also found in liver oils, butter, eggs and milk. Any excess is stored in the liver. Vitamin D is necessary for the normal absorption of calcium and phosphorus. When there is a deficiency, calcium and phosphorus are not absorbed in normal amounts, thus retarding formation of fin cells, growth of fins as well as the fish's body. A soft spinal cord and bone structure causes a deformed body. There is a danger in overdosing fish with Vitamin D because it may lead to calcification of the soft tissues, bones, and finally death.

**Vitamin E (Alpha-tocopherol)** helps prevent sterility. When absent from the diet, male fish become sterile due to degenerative changes in the testes-like organs. Females are unable to complete pregnancy successfully and the embryo dies. Vitamin E can be found in vegetables and animal oils.

**Vitamin K** Normal coagulation of blood is connected with the specific action of a number of different chemicals referred to as Vitamin K. The chemicals occur in a variety of foods and are manufactured by the bacteria in the fish's intestine. The lack of this vitamin retards digestion.

**Niacin or Nicotinic Acid** affects cellular metabolism, the maintenance of the epithelial cells, digestive tract and normal nerve functioning. It is found in yeast, fresh vegetables, meats and hops. Whenever corn meal, which has an unusually low niacin content, forms a large part of the fish's diet in dry foods, the deficiency is characterized by reddened inflammation of the outer part of the fish's body, especially when exposed to long periods of light. Diarrhea and dementia also occur. The fish's intestinal bacteria synthesize a part of the necessary niacin.

**Pantothenic Acid** is necessary for the maintenance of normal reproduction and external cells. A deficiency will cause failure of growth, dermatitis and damage to the adrenal gland. Rich sources are eggs, meats, sweet potatoes and peanuts. It affects the metabolism of carbohydrates, fats and proteins, and the transfer of energy.

**Biotin** is necessary to keep the color of the fish and prevent loss of color in its offspring. A rich source of biotin is molasses, egg yolk and liver. Egg white contains a protein called avidin which prevents the absorption of biotin. Avidin is destroyed by heat, so cooked egg white does not interfere with absorption of biotin.

**CAUTION!** As several of these vitamins are synthesized in part by the intestinal bacteria, deficiencies can be caused when drugs are used to treat fish for external infections. The intestinal bacteria are killed when the fish absorbs the drug and it reaches the intestine.

These vitamins are all necessary for proper growth, function and reproduction of fresh water fish.

*(Condensed from "Guppy News", Dec. 1963)*

## DID YOU KNOW?

*by Dennis Weems*

1. Spraying commercial glass cleansers on or near your tanks can be harmful to your fish. Never use these products on your tanks.

2. Soap, lotion, after shave, perfume, etc. on your hands and arms while working in your tanks may be very toxic to your fish and often times could wipe out a whole tank. Have you had any mystery deaths lately???

3. Water absorbs smoke, excessive smoking around your tanks can be detrimental to your fish since the absorbed smoke takes the place of the oxygen in your tank, lessening the much required supply of oxygen to your fish.

4. That most species of aquarium fishes prefer to have a varied diet of food to satisfy their taste buds, as people do. The next time you have a 3-4 course meal remember our finned friends.

*Reprint - Plecostomus - Jan. '81*

## ALERT! RED ALERT! A NEW FISH PARASITE HAS TURNED UP

It has been found in Canada. It has been found in Germany (See TFH, December 1972, "A NEW FISH ENEMY" by Dr. Gottfried Schubert, Germany). It has turned up in the U.S. and is described by Shirley Brooks in the following article in which she tells how the incurable, uncontrollable CAMAL - LANUS parasite wiped out complete lines and years of selective breeding work on guppies, mollies, apheops, limia, hi-fin platies, plus catfish, loaches, angels, etc.

Five months ago she discovered a small limia, which had two red stickers protruding from her rectum. Being scientifically curious she removed the fish from the tank, the stickers disappeared. Back in the water the fish was firmly held at an angle that made a good view of the anus possible. Before long the rectum pouched and a small, pointed, red sliver poked out. She plucked it out with tweezers and another slid 1/5" out for another grab. The next one retracted back into the intestines. Altogether ten parasites were obtained from this wee fish and a total of 25 from five small limias. Smaller juvenile versions were extracted from the mollies in the same tank.

- "Was the parasite contagious to humans?"
- "Did they need an alternate host to complete the cycle?"
- "How do they multiply?"
- "Are the fry carriers?"

As disease hooks did not provide the answers, she sent her questions to the experts along with samples and her compiled information:

"The worms are visible to the naked eye being 1/8" to 1/4" long, red in color, sucker mouthed. They seem pointed at both ends and are the width of sewing thread (juveniles are smaller).

Actual size viewed without a microscope. {  }

"Symptoms: protruding rectum, wasting fish, worms occasionally seen poking in and out while the fish is not actively moving. Later stages: fish will become deformed (crooked spine) and seem to have a stiff, immovable tail. The male fails and dies before the female. Fish are active and appear healthy until they start to waste (Her platies placed 2nd in a show only two weeks before they wasted and expired, male first, female a week later.) With females it is more detectible, as possibly the parasites get a bit crowded by the growing fry.

When taken out of the water, the parasites retract into the intestines, also when touched with the tweezers on a mss. Specimens were obtained from both sexes with no trouble. When dissecting, the parasite was only located in the intestinal track.

Fish also seem to become sterile."

Illustration: Infested fish



Dr. Harvey Blankespoor of the University of Michigan identified the parasites as nematodes belonging to the genus *Camallanus* or a closely related one. He suggested a few possible hosts.

Dr. Robert Goldstein identified them as livebearing nematodes that **CANNOT BE TRANSMITTED TO HUMANS**. He also mentioned possible hosts and suggested treatment with thiabendazole.

Following up on this information she found that there are about a "half-million" species of Roundworms - Nematodes...so therefore the genus is *Callanionus*... **species unknown**. Most are worm-shaped, contracting lengthwise, but not laterally. Their total length cannot shrink, only coil like a watch spring (microworms and earthworms belong to this class). Nematodes have a complete intestine...food goes in one end and out the other. They are difficult to identify and a few have been linked to aquarium fishes. Some require many, one, or no immediate host."

Using her "mini-microscope" she found that they were indeed livebearing, giving birth to tiny replicas of the adult worm (lacking the cutter head).

**Illustration:** A mass delivery of fully developed worms coming out of a bump (Sexual aperture) located near the center of the parasite. Nearer to the point (rear) eggs could be seen in their earlier developmental stage. The sexes are separate and the female is a mass of moving larvae.



Since the parasites produce developed miniature worms instead of eggs, it is quite possible no alternate host is needed. She observed her fish following closely, nipping and tugging on the parasite protruding from a tank mate. The juveniles could very well be eaten by the fry. When the parasite is extracted, they lay where they fall the same spot until they die. It would seem they would have to be considered edible by the fish.

So far, all of her fry are carriers. Within a few weeks they show symptoms so either this internal parasite has a rapid growth rate or the fry go around picking up the biggies. The fry expire quicker as there is no room for free-loaders. Complete infestation 6-7 weeks. Apparently this parasite **DOES NOT** need an alternate host to complete its cycle...from fish to fish.

To support this conclusion various possible hosts were eliminated one by one. Not cyclops as these were only in one of the infested tanks. Not tubificid as she does not feed them. Not snails as she killed them all and the disease still continued. Not gammarus as specimens from a heavily infested tank were examined by Dr. Blankespoor and found free of nematodes.

Dr. Schubert (TFH) has proposed the name "**cutterhead worm**" for this parasite because of the head formation of the parasite, which resembles a milling cutter head. The cutter head is hollow with cutting ribs located inside. Pieces of intestine are sucked into the hollow space in front and cut off.

Medications have so far failed to rid the fish of the parasite. Tried to date are upping the salt, malachite green, General Cure, a dog wormer (Piperazine Adipate), 0.0 Dimethyle, 1-hydroxy, 2 - trichloromethyl and Thiabendazole (a mild menatocide suggested by Dr. Goldstein). She is running out of fish to experiment on but also wants to try copper and raising the temperature to the nineties as this parasite usually inhabits cold water species.

To sum up this parasite: There is **NO KNOWN CURE**; it is **CONTAGIOUS**; it **NEEDS NO ALTERNATE HOST** and every infected fish is a potential danger. Apparently **NO FISH IS IMMUNE** from livebearers to egglayers. So if you find *Camallanus*, species unknown in your tank, mark a big "X" on the tank and count your stock as Kaput! Isolate it and research a few more medications and maybe someone can come up with a cure!

(condensed from "Valley Stream", June 1973. I would suggest reading the article in its entirety if you suspect you have this creature in your tanks!)

## A SLIGHTLY DIFFERENT APPROACH TO TREATING DISEASES...

When a fish has developed a mucous white film on its body and refuses to eat, what do you do? Patty Smith tells how they treated the tank with fungus stop, triple sulfa and acriflavine...with no noticeable improvement. She was to the point of either curing or killing in the attempt, before remembering something Francis Magrath had once said...that he never treated a tank for disease, but instead would make a complete water change.

So the tank was broken down, cleaned thoroughly and set back up. Before putting the fish back in (an oscar) the body of the fish was wiped with a paper towel and most of the slimy film came off. In just a few days the fish showed a definite improvement. He began swimming again, the white film on his body began to disappear. He ate for the first time in three weeks. After a month it was free of its malady and there has been no recurrence.

(condensed from "Fish Frontier")

\*\*\*\*\*

### FACT OR FICTION (?)

"Some people are like blisters; they never show up until the work is done!"

"Plecostomus", Aug. 1973

"Democracy is rather like sex. When it's good it's very, very good. And when it's bad, it's still pretty good."

—Ambassador John Akar

## MORE DETAILS ABOUT THE NEW INTESTINAL NEMATODES

Delane Wycoff passes along his experiences with the live-bearing intestinal nematodes (See IFGA Bulletin, Sept. 73). As with the first report, the first infestation was discovered by spotting what looked like a bunch of brown hairs protruding from the anal opening. It was identified by the University of Iowa medical center as an obviously **ovoviviparous nematode** filled with thousands of live young...many of which were escaping through the genital opening at the worm's side and swimming about under the microscope.

By the time they were discovered, the author had unwittingly infected over half his tanks. Before the 'scourge' was over he completely wiped-out one prized line and lost many other favorite fish which wasted and perished. His observations, add to our store of knowledge about this new danger to our fish.

**The worm itself:** Adult worms live in the intestinal tract of fish. There is no host specificity and no species of aquarium fishes (fresh water) has been identified as non-susceptible, although *Corydoras* is possibly resistant. Female worms may reach a size of 1 mm in cross-sectional diameter and 10 mm or more in length. Red brown in color, mature females attach themselves near the anal opening with over half their length protruding outside the fish's body. Fertilized females release free-swimming young into the water. The young will grow to maturity **ONLY if ingested by a fish**. The male worm is smaller and lighter in color.

**The spread of infestation** is from one fish directly to another as there is no intermediate host...such as snails, which are known hosts to some other kinds of nematodes. Heaviest infestations of previously 'clean' fish occur when they are exposed to heavily infested fish in small tanks. (there being a higher concentration of infective newborn worms under these conditions.)

The parasites can be spread from one tank to another three ways: (1) by moving infested fish to another tank, (2) by moving water from one tank to another, (3) by using nets or other tools previously exposed to infected tanks. In the first case, fish may appear perfectly healthy in early stages of infestation - only later do the worms appear at the anus. In the second case, when water containing the tiny, free-swimming newborn worms is moved to a clean tank, any fish that swallows them becomes infested. In the third case, the worms are carried via a net or other tool from one tank to another, again infesting any fish that swallows them. It is best to use separate nets. Second best would be to rinse thoroughly in running water any net used in infested tanks and allow it to dry completely before re-using.

**Treatment: NO KNOWN CURE.** Temporary relief can be accomplished by plucking the worms from the fish's anus with a small hemostat or tweezers. Place removed worms on a paper towel, allow to dry, and dispose of. As the worms must actually be torn from the intestine, causing some injury at the site of attachment, this approach is not practical except in light infestations. The tendency of the worms to withdraw from reach can be frustrating.

Piperazine, which works on more mobile nematodes, is of no use (either added to tank water or mixed with fish food). Piperazine paralyzes the nematodes which maintain their location in the intestine by their own motility, which are then expelled with fecal waste...but the nematode we are considering attaches to the intestine and clings tightly. Piperazine or no Piperazine.

**It is possible to save healthy fry from infested livebearer females?** Let the female drop her young in a 5 or 10 gallon tank with an efficient filter in operation. As soon as possible, net young from spawning tank into a non-infested 2-5 gallon container of water. When all young are caught, a clean net is used to net them again and drop them into a non-infested brood tank. Feed and grow as usual. Careful inspection will reveal the rare fry which has been infested. If removed as soon as detected, the remaining fry will remain uninfested. This is possible because the developing worm in the infested fry has not reached sexual maturity. It must be assumed that fry will begin eating almost as soon as born and that the birth tank contains infective forms of the nematode released from adult worms infesting the mother. Immediate removal of the new born fry is obviously a key factor. (He now has many healthy fish which are descendants of the same female which brought 'the scourge' to his tanks originally.)

**Destroy all infested fish.** Except for females which one hopes to use in perpetuating livebearing stock (as described above) destroy all infested fish as they will suffer and die anyway...whether in strict isolation or not. Any fish that has been in the same water with a fish discovered to be infested **MUST** be isolated for two months. In the end, all infested fish die.

Probably the reason that plucking adult worms from infested fish fails to cure even those with only two or three worms is because by the time the female worm is visible she has already released hundreds of young to infect all the fish in the tank including the fish that hosts the female worm that produced the young. When a parasite produces offspring which leave the body of the host and then re-enter the same host, massive infestation occurs. The restricted environment of an aquarium is the "perfect set-up for this phenomenon."

The author states, that this disease cannot be acquired by feeding any type of food which is commercially available...any food is safe food.

Hopefully the above techniques may assist someone in preserving valuable breeding stock in the face of this problem. Delane Wycoff has succeeded in completely eliminating the scourge. It took him about 18 months to do it, but using the above techniques he has preserved at least some of his prize lines.

(condensed from "Livebearers", Sept. 1973. Published by the American Livebearer Association, 2305 Broadmoor Ave., Ames, Iowa 50010.)

## THE INVISIBLE KILLERS

Can ants, flies, wasps and other insects kill otherwise healthy fish? You'd better believe it! Doug Trofiori tells how these insects can be the cause of many of our unexplained losses of fish. It is not the pesty insect that is really the culprit...it is the poisons that are strewn around by people trying to rid themselves of these and other pests.



He mysteriously lost the entire population of a 10-gallon tank of young, healthy fish whose tank had been treated no differently than other tanks near it. He was surprised and dumbfounded until he remembered that the day before he had removed a dead bee from the top of the water and that he had used pesticides, a liquid spray and dry dust, and also had fertilized his lawn with a new product containing an insecticide and a weed killer mixed with the fertilizer. He blames the loss of fish on either the bee, which might have gotten some of the poisons, or himself for having some of the poisons in his hair (head and arm) or on his clothes, although he usually makes a practice of showering and changing his clothes after using poisons in the yard.

He goes on to list several ways in which poisons can get to your fish, causing loss of fish for no apparent reason. Glancing through the list should be enough to make you think of the many, many other similar ways in which the invisible killers can get to your fish. We have all had unexplained fish losses from time to time which might be traceable to any one of these or similar causes.

1. Dusts, powders or liquids used as insecticides, germicides, fungicides and weed killers. They are dangerous, days after application, as the residues remain on plants and flowers. This is one reason for washing fruits and vegetables before eating. Cut flowers will have the same residue.
2. Solid, hanging fly strips are quite dangerous. He tells of an actual case where a dog was left overnight in an enclosed patio with one of these hanging pest strips and was found dead the next morning.
3. Touching dogs or cats that have been dusted can transfer poison residues to your hands.
4. The fly or mosquito you feed to your fish...maybe your neighbor has just emptied an aerosol can trying to kill them, or maybe it had just crawled over the ant cup you have hidden behind the refrigerator, or perhaps it has just eluded tree spraying, air spraying or other dangers.
5. What about that worm you just found in your yard? Did you use a weed killer to rid yourself of dandelions, crab grass, or an insecticide to rid your lawn of Japanese beetle grubs? He has some...not enough to kill him, but maybe enough to kill your fish.
6. Other invisible potions include hair spray, oils and deodorants you touch to apply.

There are many more but these are enough to get the point. Caution and cleanliness will help eliminate some of the losses. You wash your hands before you feed yourself...make it a practice to wash your hands before you feed your fish or change any of their water...

(condensed from "Tranquidizer", Vol. XI, #X)

## LET YOUR FISH FEED YOU

No, we don't mean eat your guppies! But if the current prices at the supermarket are getting you down, here is an excellent way to delight the budget maker in your family by using your fishy know-how to provide protein for your family. Experiments as far north as Falmouth, Massachusetts are proving that backyard fish farms can produce a year's supply of protein at little cost in time or money. (And think of the hours of fun the kids can have fishing!)

If you don't already have spare equipment in the back of your fish room that could be used in the project, do as the Massachusetts group did and comb the town dump for junk to improvise with.

The Massachusetts gang experimented with raising Tilapia, a spiny-finned food fish native to tropical Africa but transplanted to many parts of the world where, commercially grown, they provide a cheap, rapidly-breeding source of protein. Apparently they had not been tried so far north before.

Two pool set-ups were tested. The first pool, covered with a geodesic dome of plastic and wood, used a wind-powered filtration and aeration system and a combination of vegetable waste and natural plant and insect life to feed the school of Tilapia. The second pool raised a similar school at a much lower outlay and without filtration, under a flat plastic cover like a hot bed. A few pounds of commercial trout feed augmented the natural diet in the second pool. Although the second system was considerably less costly, both systems proved to be about equally effective...each producing about 100 pounds of edible fish in less than three months.

They even carried the testing as far as the table, using three recipes. Pan frying in butter and pan-frying in olive oil both produced excellent results although the favored recipe was baking the fish in foil with olive oil, lemon juice, parsley, salt and pepper. The group unanimously agreed that the fish were firm and tasty...far superior to commercially grown hatchery trout and second only to fresh-caught mountain trout.

The experiment is continuing. They are looking for a method of population control so that fewer but larger fish can be produced, perhaps by introducing a predator such as perch. They are working on refinement of solar heating to lengthen the growing season and are also testing their techniques on cold water fish such as trout and perch.

John L. Hess, whose report of the Massachusetts experiment appeared in the Honolulu Star-Bulletin, did not say how big the Tilapia were at the beginning of the experiment (or at the end), nor did he specify which branch of the Tilapia family tree was used. Different Tilapia species grow from 7-12". Most are mouth breeders but the largest Tilapia spawns in typical cichlid fashion. He also didn't say how big the pools were, nor how many fish were in each initial school. (If you have a swimming pool you don't use in off months, you might try stocking it...omit the chlorine...a park in the San Diego area provides trout fishing every year for the kids by stocking their pool with trout during the winter months!)



## TRY THIS FOR TAIL ROT

by Midge Hib

Until discovering this method of treating tail rot, I had previously run into one problem or another with any other method of treatment. I tried...either the medication did little or nothing to cure the tail rot, or it worked fine on the tail rot but damaged the health of the guppy itself.

Having gone through a wide variety of formulas to cure the back of the guppy breeder, I gradually reached the conclusion that anything that was strong enough to cure the tail rot before the show value of the guppy was lost, was also killing for the guppy to live in safely.

The answer had to lie in getting a super strong dose on the tail area without giving the guppy the same dosage. Since this theory obviously does away with adding medication to the tank water, the next logical step was to net the guppy out of the water for treatment.

To make a long story short, several methods and several types of medication were tried. The easiest and most effective method turned out to be as follows:

1. Net the fish and hold it in the net until the first wild thrashing around stops.
2. Hold the fish firmly but gently within the net so its head is up and its tail is down. Thus a view to the strong medication must not run down to the gill areas. Should this happen, immediately return the fish to the tank and cross your fingers.
3. Paint the exposed side of the guppy tail, beginning at the peduncle and concentrating on the anal fin where the tail rot is most severe.
4. Paint the other side of the tail right through the net from the outside.
5. Wait about 20 seconds after painting then return the fish to his home tank (providing of course that it is clean and well cured fish).

All signs of tail rot should be gone by the next day and within a week new growth should be visible. Occasionally a fish needs more than one treatment (maybe a spot was missed during the first treatment). Because the functional part of the guppy does not come in contact with the medication, it has proven perfectly safe to repeat the treatment as often as necessary to clear up even the most persistent tail rot.

The medication that has proven most effective on my guppies is Tetra care Fungistop (active ingredients: colloidal silver, sodium chlorate, Magn. sulphuric) used full strength from the bottle paint applied to the tail. It seems to stop the tail rot "right now" and re-growth begins quickly. No need to trim away diseased areas. If the tail rot has not been allowed to progress very far, the fish is back in show finnage in no time at all. And since it is not necessary to add medication to the tank water, the fish is not weakened but remains hardy and vigorous. It has certainly proven to be the quickest, safest method I have come across.

## HANDY HINTS FROM HERE AND THERE

### TO DETERMINE THE CAPACITY OF AN AQUARIUM IN GALLONS:

**Square or rectangular:** multiply the length in inches by the breadth and this by the height. Divide the total by 231. **Round:** Multiply the square of the diameter in inches by the height and this by 0.034. (To square a number, multiply it by itself).

### TO DETERMINE THE WEIGHT OF WATER IN AN AQUARIUM

Multiply the number of gallons by 8.34, which gives the weight in pounds. (*Wet Thumb, April 1972*)

### USE FOR DIRTY OLD AQUARIUM WATER

Save the old aquarium water carefully syphoned from the bottom of tanks. Try using it on house plants. What better plant food could you find?

### DIRTY USED FILTER MATERIAL:

Use as a mulch in flower pots as it is loaded with nutrients...or use it to cover the bottom drainage hole. Water will seep through but dirt will remain in the pot. Roots will enjoy the nutrients. (*Valley Stream*)

### MAKE CRYSTAL PAINT CHEAPLY

Dissolve methballs in a small amount of lacquer thinner. When dissolved, add the mixture into lacquer of desired color and apply to OUTSIDE of tank glass. Be sure to do all this in a well-ventilated, flame-free area. Experiment to find how many methballs to add to a given volume of lacquer to get the result you desire. (*Harbor Aquarist*)

### CLOGGED FILTER TUBES:

Soak them in vinegar (acetic acid) at least overnight. Phosphoric acid can also be used as both dissolve much of the calcium carbonate which builds up in the filter tubes. (*Harbor Aquarist*)

### REDUCE TEMPERATURE CHANGES TO FISH, CARRIED TO BOWL SHOWS

Particularly in winter months. About a week before the show, start lowering the temperature in the home tank to 70-71 degrees. When you get fish back home again, you'll find the temperature in tank and bowl are not more than a few degrees different. (*Fin Fax*)

### WASHING CHARCOAL

Try taking an old window screen, fine, and place over four corner brick. Then spread charcoal on top and hose it off. Use easier charcoal than ever before with less washing time involved. (*Aqua Tidings*)

### GOOD FILTER MEDIUMS

Perlite the planting filler found in garden shops makes an excellent, cheap filter medium. As it is very light weight the filter will have to be weighed down. Be sure to save the dirty filter medium as it is more useful than ever for use on plants.

Nylon stockings bleached and rinsed well make a good filter medium. Can be reused by rinsing off and soaking in mild bleach, rinsed thoroughly and sun-dried.

## SOME HARD FACTS ABOUT ERYTHROMYCIN

From Mardel Laboratories, Inc.

Misinformation about the correct treatment of home aquarium problems appears too frequently in the press and club publications. Good, solid, reliable information seems to be scarce. The reason, of course, is that there has been very little good research done in this field. Technical people, who should know better, make firm statements based on analogy to other systems and not based on laboratory results.

Dr. John Gratzek and his workers at the University of Georgia have done much good laboratory work that has been of benefit to the industry and the hobbyist. However, even good research can be misinterpreted.

In a paper by Collins, Gratzek, et al\*, they conclude that... "Treatment of a recirculating system with a single dose of erythromycin (50 mg/liter) resulted in nitrite reduction and stopped nitrification for 14 days..." In other words, the product caused the biological filter to stop functioning.

This has been widely reported in the press and club publications. However, two very significant details in the paper have not been reported in these publications:

1. The product tested was lauryl sulfate salt of the propionyl ester of erythromycin (Hosone-Jib Lilly Co.).

2. The product was used at a concentration of 50 mg/liter.

Why are these two details important? First, one of the most widely known and used antibiotic available to hobbyists is Maracyn and the active ingredient is erythromycin, and more specifically erythromycin phosphate - not Hosone - Jib Lilly Co.). Secondly, Mardel's recommended dose for erythromycin (Maracyn in home aquariums is 5 mg/liter or 10 times less than used in the above experiment.

There appears to be a significant difference between erythromycin phosphate (Maracyn) and the lauryl sulfate salt of the propionyl ester of erythromycin - Hosone - Jib Lilly Co.) for at a later date, additional experiments\*\* were performed in Dr. Gratzek's laboratory identical in character to the ones reported above using Maracyn instead of Hosone - Jib Lilly Co.) resulting in this conclusion:

In other words, Maracyn (erythromycin phosphate) does not affect the biological filter.

Hundreds of thousands of hobbyists already knew this because their fish were not poisoned by ammonia or nitrites when they treated their fish with Maracyn. All Mardel products have been thoroughly tested prior to introduction and quality control tests are performed on every lot (including biological assays where applicable) and we continually stand ready to help you with all of them.

If there are any questions about the above reports or products, please do not hesitate to call or write Mardel Laboratories or Dr. Gratzek.

Ray M. Johnson  
Mardel Laboratories, Inc.  
3-1-78

\* "Effects of Antibiotic Agents on Nitrification in an Aquatic Recirculating System" M. T. Collins, J. B. Gratzek, D. L. Dawe, and T. G. Metz, J. Fish. Res. Board Can., Vol. 33, 1976.

\*\* Unpublished report from J. B. Gratzek dated January 4, 1977.

## WHAT CAUSES THE "WHIRLIES" IN MALE GUPPIES

by Warren Bushe

The following are some of the highlights from an article written to us from a breeder of long experience. I'm sure they will be a great help to novice and expert alike.

1. One of the major causes of the illness which causes the male guppies to spin around in the tanks is due to long inbreeding. Mr. Bushe recommends never inbreeding over 12 generations.
2. Always start your strains by purchasing some true breeding stock from a reliable source. He recommends that the fish, males and females, be between 4 and 6 months of age and all be virgins.
3. The lighter the pigmentation of a fish, the fewer generations can be safely inbred.
4. Try to keep the temperature in your tanks between 74 and 76°.
5. Change about 50% to 75% of your water weekly. The best way is to use aged water and change about 10% per day.
6. The filter fiber you use should be changed once a week and the entire filter changed every third week.
7. Warren suggests using glass gravel in the bottoms of your filters. It is his belief that the helpful bacteria is retained in the glass gravel and it helps fight off the harmful bacteria caught in the filter fiber.
8. The lighter the pigmentation of the fish, the softer your water should be.
9. Pigmentation in guppies is affected by the pH. The lighter strains prefer about 7.0 to 7.2 and the darker strains seem to prefer 7.2 to 7.6.
10. Try using salt in the aging process of your water. Warren uses 8 level teaspoons per 10 gallons of water. Always use uniodized salt.

A committee is a group of people who talk for hours to produce a result called "minutes".



## BEWARE OF GAS EMBOLISM IN YOUR FISH,

by James Lunghammer

In cold climates, aquarists must be very careful in replacing tank water with tap water. Aging water for 24 hours is not (1) to get rid of chlorine, nor (2) solely to enable equilibration with room temperature, but rather (3) to get rid of excess gases that come out of solution. Why?

Cold water has a very great capacity to hold dissolved gas—chlorine, oxygen, nitrogen, etc. All summer we replace water carelessly and no problems occur since the coldest city tap water we get here in the Detroit area is usually 65° F. But in the winter, the cold water may drop to 40°, with a fantastic load of dissolved gas, much of which comes out of solution as bubbles when the water is warmed.

The hasty aquarist mixes a small amount of very hot water to the cold and gets a tempered water mixture which he adds to his tank. With a small percent of water change, perhaps no damage will be seen, but a massive change can be disastrous!

The fishes' gills are quite permeable to dissolved gases. Almost instantly osmotic movement of gas molecules will begin to even out the gasses between the fishes' blood and surrounding water. Simultaneously the super-concentrated gases are slowly coming out of solution from the suddenly warmed-up water. Remember the bubbles you see all over the leaves and plants? These same bubbles are immediately forming throughout the capillaries of the fish. Often intense pain results and horrible hemorrhages occur as the vessels rupture. The fish may show obvious bubbles in fins and skin. Death frequently follows. Need I say more? Age that water 24 hours to let the gas escape harmlessly. (Reprinted from "Pulse" in "Tropical Tank Talk" Jun. 1972.)

## PISCINE TUBERCULOSIS IN LEBISTES RETICULATUS

Although tuberculosis is unknown to many aquarists, it is the most dangerous disease of aquarium fish. Yet, as with many tropical fish diseases, it has been insufficiently studied. Often the external symptoms are identical or closely resemble those described for ichthyophthiriosis. It is very easily confused. The causative organism is not detected in smears. In 1997 fish tuberculosis was first identified by Bateson, Dubard and Torre. They found the acid fast bacilli in the body cavity of a carp. In 1954 Reichenbach-Klinke located the bacterium in guppies. This was the first positive identification in guppies.

Bacteria are unicellular organisms that lack a nucleus like that of higher organisms. Because of their minute size, they can easily be spread anywhere. Piscine tuberculosis is caused by the bacterium, *Mycobacterium piscium*. Although the disease is fairly rare in wild fishes, it is becoming very widespread in aquarium fish. The genus *Mycobacterium* also includes the causative agent of tuberculosis in man. There are at least two species of *Mycobacterium* that occur in fish which can also be pathogenic to man. Which is why it must be pointed out that accidentally drinking aquarium water should be avoided when siphoning and also reaching into the aquarium with cuts or open wounds. Common sense would indicate the possible hazards by subjecting an open cut to a high bacterial environment such as an aquarium.

The signs of fish tuberculosis are extremely varied. There are many cases where a fish has died of *Mycobacterium* infection, but death was not preceded by external signs. The fish often showed a loss of

appetite and internal emaciation, sunken belly. This is also evident by their thin, knife-like backs and a loss of color and paleness. An often noticed sign is deformities of the mandibles or lower jaw bone and the vertebra column. This is one of the major causes of crooked spines in guppies and not excessive inbreeding as previously thought. Exophthalmos, bulging out or staring of the eyes is an external symptom, although not always, caused by tubercles behind the eyes. The oblique, listless manner with which they swim, is evidenced by the retracted caudal fin, a hanging belly and banging themselves against the corner of the tank. On the surface of the internal organs may be soft pea-sized nodules or lesions of dirty grayish color. The swim bladder is white and full of a serous, watery fluid.

Chemotherapy is so far not effective. Although in 1966 D. A. Contoy reported 1.01% Kanamycin in the feed was effective. Experiments with various drugs in human treatments are still in their stages. It can be surmised on the basis of past research that tuberculosis is one of the results of a defective hygiene in the tank or pond, as occurs with tuberculosis where poor housing facilities result in a higher incidence of the disease. In practice, it is impossible to prevent your fish from becoming infected with *Mycobacterium*, yet, fish kept under optimal conditions are rarely contract tuberculosis. Within the past few years, evidence has been forwarded by Nigrell and Vogel, 1963 that tuberculosis can be transmitted by the intra-ovarian route in platys. The embryos acquire the infection through ingestion of the intra-ovarian fluid from the infected ovary of the female. It is this author's content on that that it is quite possible also in guppies as well as other viviparous fish. If mortality due to this disease occurs in your aquariums, all suspected fish should be destroyed. Make sure that no dead or dying fish are left lying in the tank. They will release masses of bacteria which will be particularly virulent or aggressive to live weak fish. The tank should be torn down and thoroughly disinfected. It must be remembered that only live fish are of value for investigation by a fish pathologist.

Any particular problems or questions will be answered possibly in future issues.

by Charles Dale Meryman

The Fish Doctor



## DISEASES IN GENERAL

by Randy McDonald, PPGA Active Member

It has never ceased to amaze me how diseases can spontaneously appear out of nowhere in people's aquariums, despite careful tank maintenance and optimum conditions.

First of all I have never seen a guppy, who would not do as well or better in a tank that is pea green than if it was crystal clear.

Anyone who has ever seen a guppy's natural environment will tell you how you can't even see into the water yet these fish are the most active, healthy fish you would ever care to keep. Anyone who has no sea guppies outdoors in green aquariums, will tell you about color and sheen on a guppy.

**The thing that inhibits a guppy's growth is its waste products** (if you doubt this, ask Glen Parrish why he keeps one guppy to a gallon of water and changes a third of it every week). These waste products do not make a guppy more resistant or less, to any disease. Dirty water doesn't kill fish!

The thing that kills fish is fish parasites, internal and external, plain and simple. I can't count how many times I've heard the statement my fish got sick because I moved him to a different environment or I weakened him by chomping him or overfeeding him. I've been raising fish for almost twenty years (I got my first 5-gallon aquarium at age one) and I can't believe the way people are still hanging on to spontaneous generation concepts.

As far as disease goes, people just don't realize what kind of world they're dealing with. Let's start with something as simple as a virus. It's so simple that no one in the world can tell you whether it's alive or dead. It only works when it's in a live cell, and then it only tells the cell to reproduce more of its kind in virus language (I don't want to get too technical by telling you how it really does this or you'd throw this article down as fast as the "Scientific American" (Sorry S.A. - Ed. What's really interesting is how it can't reproduce and I was about using some other cell. Viruses can be crystalized, not pure chemicals yet remain virulent (capable of infecting). They are so infectious that if you took a pure culture of a virus and touched it with the tip of a sterile needle, and then touched the needle into a 100-gallon sterile aquarium, then took another sterile needle and touched the surface of this tank with it and touched another sterile

100-gallon tank of water with that needle, then took another sterile needle and touched this tank with it and then to a sterile culture dish you'd infect the culture dish every time. Now tell me how clean water is going to save your fish?

Some people think that sterilizing the water with ultraviolet light will keep the fish from all harm.

The worst disease my fish ever got, started in an aquarium sterilized 24 hours a day with ultraviolet light. The disease was pleistophora (a microsporidian protozoan). The only way to stop it is to kill everything in the tank and sterilize with a half-gallon of bleach per 20 gallons.

Now you're probably saying to yourself, "what is he trying to tell me?" I'm trying to tell you that if an infectious disease is present, your fish are going to get it, whether you feed them 20 times a day and give them a water change every day. It's as simple as that.

If your guppy swallows a spore of pleistophora, he resists like a computer program. The spore doesn't think twice about how great the condition of your guppy is, it goes right to work like a baby being born. It will then go through its natural cycle producing more spores until every fish dies. There are certain diseases which aren't quite as effective, such as tuberculosis. This kind of disease is slow, and takes its time and may lead you into thinking all diseases are this kind.

There was a time when I used to believe the healthy fish will always survive, or maybe the ones which have more immunity will survive. Believe me, it just doesn't work that way.

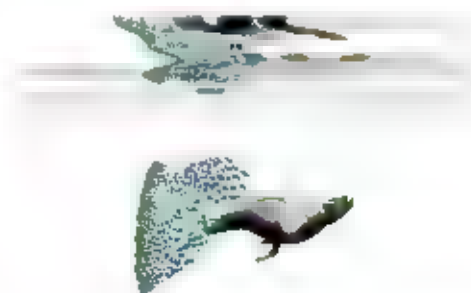
If a mosquito infected with malaria taps your blood I don't care if you eat Wheaties for breakfast and hold the world's record for big biceps, you're going to get malaria, pure and simple.

Now that we have established the fact that your fish are susceptible to anything that comes along, how do we prevent these diseases? Now you're talking, prevention is the key, not pure, sterile, clean water with superfed fish. Where do diseases come from? From other fish of course. Take the case of one of our members whose fish caught a very rare liver disease, examined and sectioned by Dr. Sy van Cohen, a doctor of pathology and fish diseases auditor. She had a pretty closed system. There were no other fish around in her house where this rare disease could come from. Then where did it come from? As Mike said, another fish, yes, the one scooped up inside of every can of flake food you've been using. Oh! You didn't read that first ingredient in all flake foods, FISH. But, you say these have been baked in an oven so everything has been killed. Try hatching a brine shrimp egg and see how fast it hatches. Or how about a live rooster which has been dried and baked at 392°F in an electric oven, or frozen down to -457°F, or kept in its dried state for 59 years and then returned to normal after adding water. Roosters are a very high form of life, being mammals like our animals. Bacteria spores can live thousands of years in temperature extremes the rooster wouldn't, even think of. Protozoan spores are almost very well equipped for temperature extremes.

Yes, your worst enemy is your flake food because, let's face it, would you grind up the sickest fish you ever had and feed it to your fish in a flake food and feel safe because it's been baked in an oven? Sure, not every fish they grind up is sick with contagious disease but as the saying goes, one bad apple can spoil the whole barrel.

*Editor's Note: Thanks Randy for an excellent article. Although the survival of bacteria and spores in extreme environments is well known, I don't know if there is any proof to substantiate the remarks about flake foods. I can think of several other possible sources of infection. In the first place, most homes also have fish in the kitchen (check your refrigerator). Many diseases are not species specific, i.e. bubonic plague affects rat and human alike and is transported by fleas. Some diseases are airborne, i.e. distemper in dogs is caused by an airborne spore. Don't forget the water we use - every once in a while we read of a contaminated water supply causing widespread human illness and remember that there are fish in our reservoirs. I believe in preventative medication to stop diseases before they get well established.*

In a lecture at one of our meetings (I think it was Dr. Cohen), it was remarked that in the natural environment, the fish are so sparse, that few parasites can find a host so that the fish are little bothered by them. In an aquarium, however, even with one fish per gallon, the parasites have a much easier time of it.



## STRESS - DOES IT REALLY AFFECT THE HEALTH OF YOUR FISH?

by Linda Miller

We've all heard the term 'stress' probably most of us have seen it on occasion in the fish we keep. But does it really affect the health of our aquarium specimens, and if so, how?

Universally accepted is the concept that the fittest will survive, be it man or fish, or microbe. In order to insure that man has a chance at survival against the constant invasion of bacteria, viruses, and the fungi, an intricate network of chemical protectors and microbial killers exist within us known as our immune system. When allowed to do the job for which they were designed, all is in balance and health is maintained. It is the same for fish.

In order that we might understand the affects stress might have on the immune system of fish, it is first necessary to understand how the system functions.

The body's first (mucus) promoted by healthy fish, is the first or primary defense barrier of the immune system. Contained within this slime or mucus layer are proteins (antibodies). Antibodies attach themselves to foreign bacteria, making them more vulnerable to destruction should they penetrate the skin. Another possibility, though unproven scientifically to date, is the question of whether the slime might not also contain enzymes capable of normalizing bacteria destruction.

The next stage of the defense system is comprised of two parts working together in harmony when the need arise, yet capable of working alone in particular instances. They are called plasma cells and lymphocytes.

Circulating in the blood stream and also found in tissue spaces, plasma cells are capable of responding to the presence of the invader by producing protein molecules called antibodies. The primary function of the antibodies is to attach themselves to the bacteria (opsonization), enabling cells called macrophages to engulf and destroy them. Portions of the bacteria itself stick in its own destruction since its protein components inhibit the activity of the other body cells within the fish called lymphocytes. When a lymphocyte comes in contact with bacteria, it touches it, somehow picking the antigen off the surface of the bacteria, bringing in the identification. The lymphocyte races back to the nearest antigen, enters one of two areas within the node, B-cell area, it literally touches thousands of B-cells, which are then activated into plasma cells. These plasma cells in turn go on to produce billions of antibodies, specifically suited to deal with the particular type of invader.

The lymphocyte then returns to the site of invasion, releasing a substance known as lymphokines. The lymphokines attract the bacteria killing macrophages to the site.

If on the other hand, the lymphocyte enters the T-cell it's status is transformed as in that of other lymphocytes, from messenger to aggressor. Entering the circulatory system, they seek out the invader and attach it to themselves. The lymphocytes will need the macrophages for the final assault, then release the lymphokines.

Like any good movie, the battle fatigued troops hold off the invaders until the cavalry arrives. Enter the macrophages.

They move in on the disabled bacteria, engulf it, and release an enzyme that destroy the bacteria, much in the same way that gastric juices aid us in the breaking down of food in digestion. Eventually, the macrophages rid themselves of the bacterial debris. Quite an intricate system, perfectly balanced, working together toward one common goal: defensive immunity.

How then is that balanced system altered during periods of stress? In the face of crisis, the human

body undergoes certain chemical changes which allow us to adapt to the crisis or stress. If you are startled in a darkened room, your response is immediate. Adrenaline is rushed to your heart via the blood stream causing your heart rate and breathing to accelerate. Your muscles are supercharged so that you may fight or flee. After the crisis is over you feel limp, shaky, drained, the result of the increased hormonal activity.

The need for survival is the same within fish. During periods of stress, such as confined fish placement, combat with a tank mate, or simply the confusion of being in an over-crowded environment, the fish must adapt to survive. Adaptation is the result of chemical changes within the fish. Fight signals the need for an increase in the levels of hormone output, including adrenocorticotrophic hormone (ACTH). Once in the bloodstream ACTH starts a chain reaction, resulting in the release of epinephrine and cortisol from the adrenal gland. The epinephrine increases the fish's ability to respond to the attack, strength to fight or speed to flee. The increased levels of cortisol assist the fish in adapting to these stress conditions, and if not prolonged, little harm is caused.

However, if the stress condition is prolonged, as it is when you are trying to net a particularly evasive specimen, he becomes exhausted and is very susceptible to shock. Stress beyond this point could easily result in immediate death. The increased chemicals that had allowed him to remain uncaught were also interfering with his immune system.

Increased levels of cortisol have been documented as having considerable influence in decreasing the effectiveness of the basic parts of the immune systems in mammals. That should have similar affects on the immunity of fish is a reasonable assumption. Noted are the decreases in the production of antibodies and lymphocytes and a limiting effect on the ability of macrophages to engulf and destroy bacteria.

I think it is necessary to point to the fact that the fish most likely harbors the potential for immune diseases in much the same way that it has been theorized that each man possesses the potential for cancer within his cells. Laboratory research indicates that bacteria is ever present not only in the fish but in his environment. Yet they are healthy fish none the less, because of their immune system is in balance. While this should not be construed as an absolute statement that only stressed fish will become ill, I think it leaves little doubt in our minds, that serious attempts to eliminate as much stress from our fish as possible could very much benefit the longevity and our satisfaction with ourselves as competent aquarists.

How can we eliminate or reduce the amount of stress that our fish must endure? There are several simple steps. Eliminate unnecessary handling and radical water changes. Avoid the skated, catch him in dawn or early morning light. While in a resting state, it is pretty easy to net him without a chase. If fish must be transported over long distances, arrange to have pure oxygen in the shipping bag. Protect against constant fluctuations in temperature. Don't make drastic, instant changes in lighting. At night, turn the tank light off a couple of minutes before you turn out the room light. Reverse the process in the morning if your tank is in an area where natural light does not penetrate, as in the case of a subterranean fish room. Basically some stress can be eliminated simply by having a considerate attitude regarding the type of environment you provide for your fish. The rewards are worth the effort.

*Reprinted from Exotic Fish Society of Hartford 3/78*

## DISEASES

by Peter Tedesco

Two of the most common of these are constipation and indigestion. This is due to improper or feeding of one type of food too much.

Occasionally a fish becomes constipated or is subject to a form of blockage in the intestines. The fish becomes generally off its habit of eating and refuses to eat, becomes lethargic and swims with fins closed. In this case, the fish should be put into a small tank by itself and treated with Epsom salts added to the water. If this works, the fish will pass heavy excrete. While the fish is being treated, change water and feed live food for a few days.

If this does not work, there is a possibility the fish may have internal growths or parasites, worms. At this point it would be humane to destroy the fish.

Indigestion is usually caused by wrongful feeding, such as excessive feeding of dried foods or it can be caused by constipation. Indigestion can be recognized by a swollen belly, air bubbles in the feces and general sluggishness. It is not a serious complaint but needs speedy action or it may lead to a more serious condition. The treatment would be the same as for constipation.

## WHAT ARE YOUR SYMPTOMS

by J. & J. Parrott

In the few years that we have been raising fish, we have been plagued by unusual fish disorders. Whenever we could describe a particular problem whether to a fish store proprietor or fellow hobbyists, no one knew what it was or could offer any suggestions to cure it. Through reading various publications and experimenting with different medications, I found cures to some of the problems.

I thought I'd cover two different problems this time and I might add that both these problems were described to me via mail not so long ago also, and the treatments below were helpful to the lady who wrote.

The first disease shows itself as hard crusty patches on the body of various sizes. They look much like salt crystals and the fish affected remain in a stationary position in the tank with fins clamped and shivering slightly. This affects fish of all sizes but mostly the females. This too always cropped up after a water change, usually when water was colder than the tank water and in the winter months (probably again a matter of colder water). I also noticed it after changing a batch of fish from one tank to another tank. It did not seem to be very contagious but would affect a whole tank at the same time. I came across the name of the disease quite by accident while reading an article on Velvet Disease. The article named some of the symptoms I was having and called it "Crystal Velvet". The only medication I could find for velvet was put out by Jungle Products called "Velvet". Following directions, the fish would show signs of improvement in 24 hours and be cured in 48 hours. seldom did I have to repeat treatment.

The second problem came up a year ago and again affected my females more than the males. It appeared as soft white patches on the back around the dorsal fin. These patches were not fuzzy like fungus but flat and splotchy looking and in extreme cases would circle the body either in front or back of the dorsal fin. This was highly contagious and cropped up in tanks all over my fish room. I took one of my worst females into a fish store proprietor well known for his knowledge of fish diseases. He said it was saddle-back fungus and came in from Florida. He said that it was a very strong strain of fungus and the best thing was to destroy any fish with the symptoms and sterilize all tanks and equipment. As I had not brought any new fish into my fish room at all, I could not understand how it got into my tanks. Later it dawned on me that I had sent a number of fish to a show in Florida about two weeks previously and these fish had been returned to me after the show. This was the only way I could think of as how I could have gotten it. Other hobbyists who had sent fish to the show had it appear in their tanks also.

The man at the store gave me some products for fungus asked to let him know what my results were. I tried all and none worked. I finally decided to try some potassium permanganate that I had. My stock solution was randomly made by mixing the potassium permanganate crystals with a gallon of water. I poured this solution into the tanks, and they were a dark purple. If, after the solution had been added, your fish show any signs of distress (floating at the top, etc.), a partial water change is in order. Be sure to use a charcoal filter with plenty of aeration. In a few hours the water will turn brown and the filter will eventually clear it along with normal water changes. Treatment can be repeated in a couple of days. This worked on all my fish including some very bad ones. I went back to the fish store and told the proprietor what I had used. He was quite surprised and he thanked me for telling him of the results.

## HYDROGEN PEROXIDE USED TO INCREASE DISSOLVED OXYGEN LEVEL

by Doug Murphy reprinted from *Through the Looking Glass* R.S. 1/77

I ran across a monthly publication, "The Progressive Fish Culturist", last week at the biology library of good old PU. It is a quarterly for fishery biologists and fish culturists published by the United States Department of the Interior, Fish and Wildlife Service. It is a good collection of papers on and publications of experiments with...you guessed it...fish.

I found several articles of interest. One of which bears reviewing. The title of the article is "Hydrogen Peroxide as a Source of Oxygen Supply in the Transport of Fish". It is written by V.B. Taratko, N.V. Huigol and S.G. Parf, Dept. of Zoology, Institute of Science, Nagpur, India.

This article involves the use of hydrogen peroxide ( $H_2O_2$ ) to maintain the dissolved oxygen supply within a closed container. It was found that one drop of 6%  $H_2O_2$ , when added to one liter of water at 24°C or about 75°F increased the dissolved oxygen by .5 parts per million (ppm).

The following chart also appeared:

NUMBER of $H_2O_2$ drops added per liter of water	Increase in dissolved oxygen
1 drop	1.5 ppm
2 drops	3.1 ppm
3 drops	4.4 ppm
4 drops	5.9 ppm
5	7.5 ppm

In one experiment, 50 *Cyprinus carpio* (carp fry) 1.5 to 2.0 cm were placed in 1 liter of water. The initial dissolved oxygen level was 5.2 ppm in this closed system. In total, .8 drops of  $H_2O_2$  were added at 4 hour intervals over a 72 hour period. The additions occurred only during the daytime. Of the fry, 86% survived and the ones that died did so during the night when the oxygen level would be the lowest. The pH was relatively unaffected, remained at 8.2 while the carbon dioxide increased from 0 ppm to 35 ppm.

Another experiment can be summarized as follows:

1 liter water both closed containers	1 liter water
Number of fry	25
Hours W/O air	72
Drops 6% $H_2O_2$	12
% Fry survived	100

Therefore, Hydrogen peroxide could be used to maintain or replenish the dissolved oxygen in closed containers.

I have not tried using hydrogen peroxide in this manner, but will definitely experiment with it before moving any great distances. I could also see myself walking into a show without air stones, tubing and only with a 29 cent bottle of hydrogen peroxide not worrying about fish in a drum bowl that is a fate too small. Hydrogen peroxide has definite possibilities.

**WARNING:** Hydrogen peroxide can be conveniently used to increase the dissolved oxygen content, but, #1 do not exceed the oxygen requirement of the fish you have. The dissolved oxygen level can become too high. #2 Hydrogen peroxide can be harmful to the fish if too much is added. **KNOW THE PROPER DOSAGE, EXPERIMENT FIRST.**

## BY THE WAY

*Tact is the rare talent for not admitting you were right in the first place.*

## ANTHUR DIOXIDE AS A DISINFECTANT FOR AQUARIA

by Warren Zeidler, Curator of Fishes, Miami Seaquarium

Anthur Dioxide is a liquid chemical complex, the basis of which is chlorine (available under the trade name Microcide). Chlorine in its many forms, is fine in swimming pools and drinking water, but always has proved a deadly addition for all in aquatic environments. Microcide is, under control, no more difficult to maintain than those for copper compounds, harmless and even beneficial to aquatic vertebrates. Experiments with anthur dioxide have proved the following:

A series of experiments were conducted involving dozens of marine and several freshwater species. Preliminary tests were run to determine the fishes' tolerances for the product. One ppm of residual chlorine was found to be toxic after 1 or 2 weeks of immersing. Specimens seemed to lose equilibrium and swim in tight circles until they expired. If caught in time and placed in untreated water they survived. Finally, 0.5 ppm residual chlorine was found to be the point at which vertebrate species can live indefinitely and at which the strength of the chemical is adequate to perform its functions. A 0.5 ppm fishes can be introduced safely into or removed from the water with no ill effects.

All tests were conducted in 5 to 30-gallon aquaria. During these experiments, several interesting points came to light. When specimens were fed, excess portions of food were left intact only on the bottom. Instead of decomposing in the usual manner (turning black and producing foul odors from hydrogen sulfide), waste portions of fish decomposed into a harmless, finely divided, granular white mass, as did waste from the specimens themselves. Even sea anemones, whose death and decomposition often annihilate marine fish populations, die the same. The color and decomposition of an anemone or other invertebrate (such as snails) did not result in the usual fish mortalities.

The chlorine product was then tested in six 30-gallon display aquaria containing numerous live specimens too small or prized to be shown elsewhere. Laboratory tests had shown that the chemical, at the relatively low concentration of 0.5 ppm residual chlorine, was not strong enough to destroy algae already established. Thus, all experiments here were conducted in aquaria which first had been thoroughly cleaned. A rule of thumb regarding the amount of chemical to be added was developed at this point. Two drops per gallon of water worked uniformly as a safe method of introduction. The final quantity required to maintain the desired level of 0.5 ppm varied according to the number and size of specimens present in the aquarium. Daily testing with the standard OTO swimming pool test kit and further addition of the chemical when needed to reach 0.5 ppm was all that was required to maintain the aquarium. Once the optimum level was reached and held for a few days, daily testing was no longer necessary. Periodic checks and chemical addition when necessary were sufficient.

Normally, the six display aquaria are emptied of their contents and cleaned monthly. This, of course, is subject to many variables with which aquarists are familiar. When treated with anthur dioxide, cleaning time was extended to 6 weeks or more, and even then there was not as much algae, snail and foreign matter present as there had been previously after only a month. Specimens retained their vivid natural colors,

fed well, and remained fully active. Their whole state of well-being seemed greatly improved, although no other variations in normal care were introduced. Bacteria counts were taken during the test period and were compared with those taken during the same time the previous year. The counts proved to be little more than half of that they had been. This provides a healthier environment and leaves enough bacteria to maintain efficient biological filtration.

Seaquarium is basically a marine exhibition, and the biggest majority of the research was done in salt water. It must be noted that ammonia dioxide is most efficient in the low pH range of fresh water therefore it is a boon to all aquarists. Of particular interest is the fact that one freshwater *Belonesox belizanus* gave birth to two large groups of normal healthy young in an established Macroside environment. A number of these were raised successfully to a length of 2 inches and then transferred to an open system untreated display aquarium without special precautions or difficulty. Regard less of the kind of water, the treatment is most effective and least expensive in completely closed (100% recirculation) aquarium systems.

*(Excerpts from an article appearing in "Ichthyologica", Vol. XXXVII, March 1966)*

### A CURE THAT WORKS AGAINST "FLORIDA FUNGUS"

It can be treated simply. If you notice a cloudy eye on a fish, watch carefully and in an hour or two you will spot a white fringe of fungus on fins and tail. Don't delay one minute. Add one teaspoon per gallon of salt. With this use a dose of acriflavine. Raise the temperature to 90°, if the fish can take it and after several hours gradually add one more teaspoon of salt per gallon. Turn on the light.

In 24 hours you may add more salt if the situation is critical; however, you probably won't need it. The fish will recover. Feed them as they seem abnormally hungry.

Keep them in salt for several weeks then taper off gradually. That is all I know about the treatment except that it works. Nothing else we tried does.

*(Reprinted from "The Fish Tale" Minut. N.D., July 1974. Author unknown as was not given an article.)*

### CHEMOTHERAPY OF BACTERIAL INFECTIONS IN FISH AND AQUARIA WITH MICROMBIALS

*by William Pantak*

Sulfas and antibiotics are becoming more common in pet shops for the treatment of bacterial infections in fish and aquaria and it was, therefore, felt that an article on the use of sulfas and antibiotics would be timely. The reason for the title is that this includes the sulfas as well as the antibiotics. These agents should be used only in bacterial infections and not as a panacea for all ills of aquarium fishes. The action of these medications is either bacteriocidal (actually kills bacteria), or bacteriostatic (stops the reproduction of bacteria so that normal body defenses can destroy them.).

**SULFAS:** The sulfas are bacteriostatic and are quite numerous, the common ones being Sulfathiazole, Sulfamoxazole, Sulfamethoxazole. Most of these sulfas are absorbed through the intestine after being eaten by the fish, both as particles and as water. However, some are not absorbed through the gastrointestinal tract and act only to destroy bacteria in the bowel of the fish and in the water itself. They may be used as a single type of sulfas or in combination with other sulfas to form a commonly used medication in humans called Triple-Sulfas.

Sulfas in compressed tablet form, crushed, are best. This crushed powder is then mixed with a small amount of aquarium water to make a solution which is then placed into the aquarium itself where it diffuses throughout the water. Dose= 150 mgs of total weight of sulfas per 10 gallons of water.

**ANTIBIOTICS:** These antibiotics, once coming from molds or other fungi, have now been synthesized and have been changed chemically so that new antibiotics can be produced. In this way new and better antibiotics able to kill a wider spectrum of bacteria are produced.

In my discussion I will be using generic names rather than brand names.

**METHODS OF USE:** Antibiotics may be used in several ways: the easiest is to dissolve the antibiotic and place it into the aquarium water. I would suggest that one use capsules of antibiotics which are pure antibiotics mixed with a filler such as starch, or else use a compressed tablet without any sugar or other type of hard coating around it. This way less foreign matter which could possibly harm the fish, will be introduced into the water.

I would also suggest that the fish be treated in a small jar or in a tank for reasons which I will discuss later. This also saves money by treating one fish in a small amount of water thus using much less antibiotic than treating the whole aquarium itself.

A method which has been used to some degree by researchers is to mix antibiotics with food. Work has been done in treating fish, both in sport fish hatcheries and fish farms. The dosage in such situations may be calculated quite easily by knowing the number of fish and the weight of each fish. This however is not very practical for the average hobbyist who has one total sick fish. Another method of treatment of fish is by injection of the actual antibiotic into the fish. The most common method of injection into the peritoneal cavity. That is, into the abdominal cavity between the intestines and other organs and the outside abdominal wall. This type of antibiotic has to be sterile and of the same type used by veterinarians or doctors in injecting the veins of animals or patients. This technique is difficult as it requires a hypodermic syringe and needle and also it is difficult to calculate the dosage. One could also damage internal organs and in this way injure the fish to such an extent as to cause death. I would not advise this method for use by the average aquarist but would reserve it for those who are skilled in this method.

Another method is by intramuscular injection with hypodermic needle into the muscle portion of the fish. Again, it is difficult as dosage has to be calculated accurately. Again, the antibiotic should be of the same type as veterinarians use in injecting animals. Not all antibiotics are meant to be injected and therefore cannot be used this way.

The most difficult problem is trying to get the actual dose to be used for injection. I have not been able to find any data which provides this information. In the following discussion of antibiotics the dosages which will be given will be those which should be used in dissolving the medication in aquarium water, then allowing the fish to swim freely in this solution.

**PENICILLIN:** This is probably the safest antibiotic there is, with a very large variation in dose level without causing harm. It is bacteriocidal. Penicillin, Ampicillin, Cloxacillin, Dicloxacillin and Methicillin are an agonized by the Tetracycline and Chloramphenicol and should not be used together. The dosage is often quoted in both units and mgs. Dose= 500 mgs per 5 gallons. In severe infections the dose may be as high as 250 mgs per gallon.

**AMPICILLIN:** This newer type of Penicillin is effective on more different types of bacteria. It is also bacteriocidal and has the same advantages as Penicillin. Dose= 250-500 mgs per 5 gallons.

**CLOXACILLIN & DICLOXACILLIN, METACILLIN:** Penicillin derivatives with a different bacterial spectrum from Penicillin. They have the same advantages as Penicillin and have quite a wide range of safe dosage levels. They are bacteriocidal. Dose= 250 mgs per 5 gallons.

**CEPHALORIDINE:** Very similar to Penicillin. Bacteriocidal. Can be used in intramuscular injection with another form that can be used by dissolving and adding to aquarium water. It is not readily available for use by the average aquarist. Dose= 250mgx per 5 gallons.

**ERYTHROMYCIN & OTHER MACROLIDE ANTIBIOTICS.** (Spiramycin, Clindamycin, Tricetyloleandomycin, Carbamycin) These antibiotics are bacteriostatic and have a bacterial spectrum very similar to Penicillin. They are antagonistic against Lincomycin, which will be discussed later. Erythromycin is available both in a compressed tablet form and in a capsule. It may be purchased in pet shops. Dose= 250 mgx per 5 gallons of aquarium water.

**CLINDAMYCIN & CLINDAMYCIN:** These are closely related and are bacteriostatic. Somewhat similar to Penicillin in use, however they should not be used with Erythromycin as they are antagonistic towards it.

**NOVOBIOLIN:** It is bacteriostatic and has a similar bacterial spectrum to Penicillin. It is not used as much as Penicillin since Penicillin is cheaper and more readily available.

**STREPTOMYCIN:** It is bacteriocidal and an excellent antibiotic, however most bacteria become rapidly resistant to it. It is therefore used almost exclusively for treatment of TB in humans and I would not advise it for aquarium use at the present time.

**TETRACYCLINES:** These include Terramycin, Aureomycin and Tetracycline hydrochloride. It is bacteriostatic, effective against a broad range of bacteria and very useful. Dose= 250 mgx per 5 gallons.

**NEOMYCIN, KANAMYCIN, GENTAMYCIN:** These antibiotics are not absorbed well by the gastrointestinal tract and therefore are suitable in the aquarium for any infections arising on the outer surface of the fish, such as fin rot. Neomycin has now been marketed for aquarists and is available at pet shops. Kanamycin and Gentamycin can also be used for intramuscular injection. Dose= of Neomycin= 25 mgx per 10 gallons of water.

**POLYMYCIN B & POLYMYCIN E:** Bacteriocidal. They appear to have been very limited in use in the fish hobby.

**VANCOMYCIN & RISTOCETIN:** Bacteriocidal, however they can be used only intravenously and are not applicable to aquarium use.

I have included most of the antibiotics available even though not all can be used by the aquarist. However, for the sake of completeness I have listed them as you may hear of them being used in the future.

**CONDITIONS IN WHICH ANTIBIOTIC & SULFAS MAY BE USEFUL:** These chemotherapeutic drugs should be used only in infections or in bacterial conditions where a bacterial infection is part of another disease process brought on by the poor resistance of the fish because of poor health. This may occur in fish which have been traveling over long distances, which are in a state of starvation, and where the natural defenses have been decreased. Fin rot is an example of a disease where they may be used. Traumatic ulcers caused by bites from the other fish, by sharp rocks, etc., and which have become infected, or are in danger of becoming infected. There may be an overgrowth of fungus on such areas. Fungus normally grows on dead tissue which have been produced by some type of infection, usually an ulcer.

One may also use antibiotics preventatively. When new fish are acquired, especially if they do not appear to be in the best condition, they may be given a treatment of sulfa or antibiotics to combat bacteria infecting present in the fish or in the water. The chemotherapeutic agent will fight these organisms until the fish have recovered their natural resistance.

Unfortunately very little is known about bacterial diseases in fish and even less has been written about them. This is a wide open field and eventually biologists, bacteriologists and other interested learned people will tackle this huge problem in the near future to provide us with knowledgeable information regarding bacterial fish diseases, both from the standpoint of causative organisms and their treatment.

**DANGERS:** Unfortunately, antibiotics do not discriminate between 'good' and 'bad' bacteria. Good bacteria are those present in the gravel of your aquarium which break down the excreta of your fish as well as uneaten pieces of food, dead plants, etc.

Good bacteria also help digest food for the fish and provide important vitamins as well. They are present in the stomach and bowel of the fish. These good bacteria also live in the constant state of balance may be destroyed by an antibiotic so that there is an overgrowth of harmful bacteria or fungi. Therefore, it is best to treat fish in a separate 'hospital tank'. However, even though this does not prevent an upset in the bacteria of the gastrointestinal tract of the fish being treated. Consequently, do not treat too long. Seven to ten days should be the maximum length of treatment.

**AVAILABILITY:** Although some of the medications mentioned are available only in hospitals, most can be obtained in pharmacies as prescription drugs. One would therefore require a MD's, dentist's, or veterinarian's prescription. The drugs used by humans have to go through rigorous standards and therefore their prices are high. Prescriptions by veterinarians are usually considerably cheaper.

Recently some drugs are finding their way into pet shops and may be obtained off the shelf. When buying such medications, read the small print, as it is there that you will find what the active ingredient is, not in the trade names which are made to sound good so the product will sell. Recently I have surveyed local pet shops and found the following medications available which I will list giving the antimicrobial present and the dosage stated.

**Fungus cure-** Active ingredient-Sulfathiazole with some added acriflavine. Dosage- 1 tablet per 5 gallons.

**Sula-Four-** Combination of four sulfas, Sulfathiazole, Sulfamerazine, Sulfamethazine and Sulfaguanidine. Liquid. Dose- 65 mgx per 5 gallons.

**T-C Caps-** Active ingredient Tetracycline hydrochloride. Capsule form. Dose- 250 mgx per 10 gallons.

**Marucyn-** Active ingredient Erythromycin. Dosage- 1 (200) mgx capsule in 10 gallons water.

**General Cure-** Active ingredient Neomycin combined in a dosage of 10 mgx together with Copper Sulfate. 1 tablet can be used in 5 gallons of water.

This paper is far from complete on the antimicrobials, but as I mentioned before, very little has been written on the subject of bacterial infections in the aquarium. I hope this short resume will be of some help to those of you who read it in treating their infected fish. I further hope this, somehow much more knowledgeable than I will take up this challenge and provide us with some truly good research and eventually information so that there may be some light shed on this greatly neglected aspect of tropical fish diseases and take us out of the Dark Ages where we are at the present.

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## BY THE WAY

*Dermatologists make rash judgements*

## CHECKLIST BEFORE MEDICATING

*by NANCY WHITE, GAAS*

Your fish are not acting right. They're not as anxious to eat as normal. Maybe one or two have died recently. What should you do?

1) Make sure the heater is not stuck on or off. Check the temperature with a reliable thermometer. To check thermometer accuracy, place it under your arm against the skin for 5 minutes. It should read 95-96°.

2) Check the pH of your tap water, then check the tank water's pH. If your tap water is constant and if you are doing nothing to alter the pH in tanks and if you are making regular partial water changes, (which you should be doing), then the pH reading of your tap and tank water should be very close to the same. If there is a definite color difference in the test solutions, something is wrong. Possibilities: not making partial water changes regularly, excessive uneaten food or dead fish/plants decomposing, pH altering substance in tank (rocks, shells, some grates, etc.).

3) If just one or two fish dies for no apparent reason, think about the species that died and ask yourself: Is it usually tank raised or imported wild? If wild and old, it could have been old when you got it. If you have had it for a couple of years it could be old (for its species) also. The point being: fish do not live forever. Excluding cichlids and scavengers (catfish, loaches, etc.) life span of the most commonly kept aquarium fishes is 2-4 years (barbs, tetras, guppies, livebearers), with exceptions of course. If you start with juveniles, you can usually assume they are under 6 months old and how long you've had them to determine age. If you buy adults and don't know the background, you're taking a chance on age.

4) Check floating plants. They can catch uneaten food and debris and restrict water/surface exchange of carbon dioxide and oxygen due to reduced water circulation. Swish plants around now and then to keep them clean and trim them out if prolific.

5) Make sure air flow is properly set and that water circulation is not impeded by dirty, clogged filters.

6) Could you be experiencing the "New tank Syndrome"? In a newly set up tank with new (even if aged) water, there is a lag before the "good guy" bacteria are established enough to break down the ammonia produced by uneaten food and fish wastes. This can be speeded up by adding water/gravel from an established tank. The first 4 weeks of any new set up are critical and if you have not planted bacteria via some used water and/or gravel, you should make frequent (twice weekly) partial (15%-20% water changes to dilute the ammonia build up until the bacteria are established enough to handle the ammonia load (usually established by 4-6 weeks). As a way's, but especially in a new set up, DO NOT OVERCROWD. After 6 weeks, a 20% water change per week should be adequate. If this amount seems to stress the fish, reduce to 5% etc.

7) Check fish food. Frozen food should have good color. Flake foods should be kept dry to avoid mold. Live food should be lively for its kind.

If you have found a problem and corrected it, WAIT a few days for the fish to resume normal activity. Don't expect them to snap back immediately if they have been under stress. If #1-7 above are OK and your fish still aren't acting right, change water a little more frequently (not more water, more often), add a teaspoon of salt per 5 gallons, gradually, and increase the air. WAIT a couple of days for improvement.

Internal problems baffle the experts, so don't guess at medicating for something you can't see. Those external diseases we can see are mostly preventable by good aquarium management. As a matter of fact, should we ever medicate? We personally believe the answer is very seldom, but if you feel you must medicate, eliminate possible causes first. THEN decide if medication is necessary. If so, proceed with caution, wait patiently for results, and keep your fingers crossed, which may help as much as the medication!"

*reprint from Greater Akron Aquar. Society 4/77*

## A BEGINNER'S GUIDE TO DISSECTION

*by Alex Bartsch, Berlin*

Have you ever heard that fishes can get sick? According to an old German folk saying "I feel healthy like a fish in the water." Apparently they don't.

Do fishes get sick? Yes, friend, you and I know the trouble, we and our fishes can get sick. What is it that diseases, and kill our fishes? For most of us it is the Shakespearean question from Hamlet: "Who knows and who says?"

Sometime ago I was breeding guppies and in looking around to find some new babies to cross with my colorates I got some very good ones from a friend of mine. Unfortunately my very active "bulls" started to die. I didn't know what to think of this, for the tanks of my friend were very neat and his fishes as healthy as fishes. Yet with me, his fish and my fish died in droves. Having been trained well in the use of a microscope I did an investigation of these fish under the tube.

Have you ever seen wiggly scales on fishes? I never had and so I decided that something must be wrong. It was! On some of the fish scales, I found living worms! Not just a few. Some of them seemed to be covered with the worms. Naturally, the activities of these parasitic worms weakened the fish and made them not only ill but dead.

Where had the worms come from? In the tanks of my friend all the fish were healthy. The only thing was, they were packed like sardines in his tanks. Yet they were living peacefully and gave him plenty of new babies for the strain he was developing. I decided that the worms found in my tanks and my way of caring for my fishes quite attractive. They found the conditions so good that they multiplied in large numbers very rapidly.

What was this worm? It was *GYRODACTYLUS*, a fluke in which is found, inside the mother an embryo, with an embryo in it and another embryo inside of that one. As you can see these worms can do a lot of multiplying and this can be disturbing not only to your fishes, but to you as well.

Like the "gyros" I have found that many parasites such as bacteria and so on, are latent on or in most fishes. They lead a peaceful, unnoticed life until something in their existence is changed. These changes

are not usually the best for the fishes but they are an advantage for the "bugs". Sometimes, a change which is not noticed or seen by you, awakens the violence and then trouble brews. Crowded tanks with plenty of wastes and so on are some of the main reasons for this change. Also, if you buy some new fish you may find that they will infect the fishes you already have. I learned from my experience with *Gyrodactylus*, that any newcomer has to stay in quarantine until I can be pretty sure that all is okay.

The next question is what to do with sick fishes or a full fledged epidemic in your tanks? This depends on your knowledge of fish diseases. Of course you can always go and buy yourself some of the remedies and wonder whether they will help or not. Mostly they don't. I definitely don't want to say anything against the remedy industry, but please feelers, find me some really helpful remedies for economy minded aquarists. Of course, many remedies help for awhile, at least until the next outbreak. Even knowing that, many aquarists put their hands in their laps and are satisfied. Of course some don't give in so easily and shift their tanks around, scratch their ears and decide: "It must have been ich or something" and then put their hands in their lap!

Of course you can write to a "specialist" in an aquarium magazine for advice usually with the following results:

Mr. X: "My fish were doing fine but lately they have not done too well" and I found out that

Mr. Specialist: "Well, it's fine to hear that your fishes are doing fine and it is finer still that you wrote to me for advice. Here it is: Like you, I once had the same experience and like you, I had the same problem. I didn't know what to do and so I decided to work with some

OTHER INFO

Big help, eh?

**What is the cause of diseases in fishes? What is the proper course to take to effect a cure?**

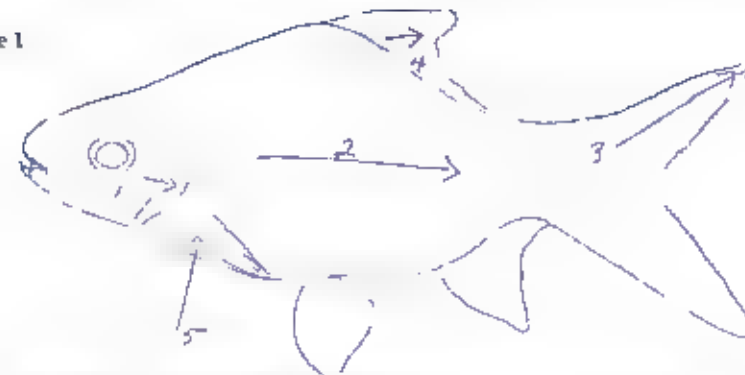
One basic thing should be kept in mind: A healthy looking fish maybe healthy but then too, it may not be healthy. If your fishes are looking and acting healthy, then all will usually be okay if you take proper care of the fishes and the tanks they are in. If anything changes in the behavior of your fishes it may be that you did something wrong. A latent disease may have become active and now the most difficult problem is yours. What disease is working on or in my fishes? Which kind of remedy can bring back the healthy look of my fishes? In short, the problem is what to do to correct the situation and bring things back to normal.

The best you could ask for would be if some external parasites are at work on your fishes. For instance worms like *gyrodactylus*, which you can kill before they kill the fishes.

For bacteria, fungus and algae there is hardly anything that is totally effective. The same is true with internal diseases and parasites such as tapeworms. Lately good results are being obtained from the use of ozone. You may have read about the Sander Oxonizer to advert serpents in aquarium magazines. It's probable that you do not know too much about ozone (O<sub>3</sub>) and it is not surprising. I will try to tell you some other time about ozone and what it is doing for the aquarist in Germany.

With any sickness, the main problem is to know which kind of disease you have to fight. To answer this question, there is more to it than throwing away the dead fishes! The catalogue of fish diseases is a very long one. If you know what to look for you can often see the "bugs" with a magnifier or a school boy's microscope. In the future, I hope to present the readers with a catalogue of the common fish diseases. Perhaps this will help you to recognize the signs which determine the specific disease. But here let me give you some idea of what you have to look for with a sick fish.

Figure 1



The arrows illustrate method and direction of strokes to obtain slime samples from a fish. Each area should be examined separately.

1. - From the gill plate
2. - Along the side of the body
3. - Caudal Fin, along the rays
4. - The same as #3 on the dorsal fin
5. - A sample should be taken from the plet where the pectoral fin joins the body.

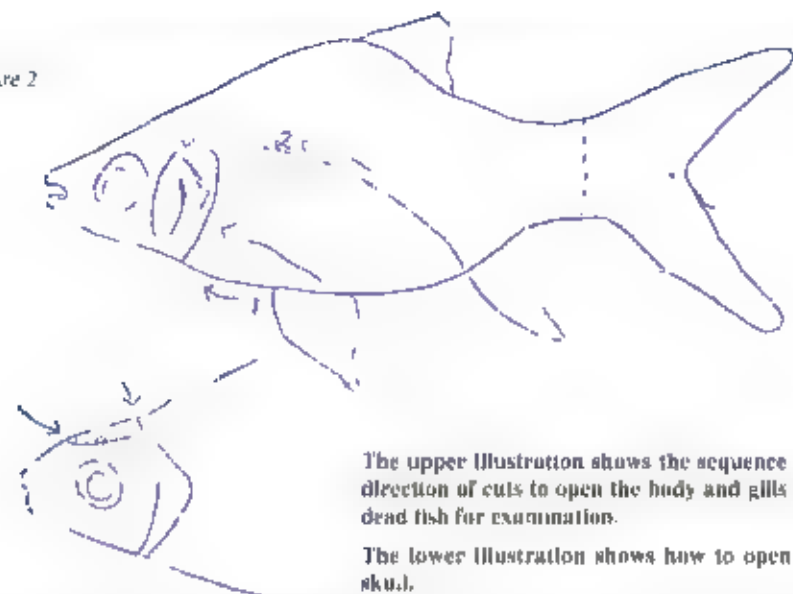
#### LET US BEGIN WITH A FISH WHICH IS NOT DEAD YET

Catch the fish and carefully put it on a wet piece of tissue paper, cover it with the same wet material. Then gently uncover the part of the body you wish to look at. If you have to look over all the fish do not uncover the whole animal at the same time but rather examine small areas. The most fish can be handled in this manner. If you have noticed anything unusual about the skin examine it first. Prepare some tiny tips from cotton wool before netting the fish. (Editor's note: "Q-Tips" are ideal. With these tips gently take some samples of slime from the skin of the fish. If there is nothing noticeably unusual, then take samples from the areas indicated in Figure 1. **BE CAREFUL TO TAKE YOUR SAMPLES BY MOVING THE SWAB IN THE SKETCHED DIRECTIONS.** You must handle the fish with gentle hands or you may kill it.

Now, place a drop of water on a microscope slide and place some of the slime from the swab in this drop of water. Examine this under the microscope. If you see nothing don't be too surprised. You probably don't know what to look for. I will try to show you when I present my catalogue of diseases. But this method will show you some of the larger parasites.

If you do not find anything with the microscope, you may have to dissect the fish for the sake of the others. Figure 2 shows you how to open the body cavity and the gills. **When she is not looking**, take the finest nail scissors from your wife's manicure set. These are ideal for opening the smallest of fish. Figure 3 should give you a general idea about the anatomy of the average fish. The pre-operation shows the sequence and direction of cuts to open the body and gills of a dead fish for examination.

Figure 2



The upper illustration shows the sequence and direction of cuts to open the body and gills of a dead fish for examination.

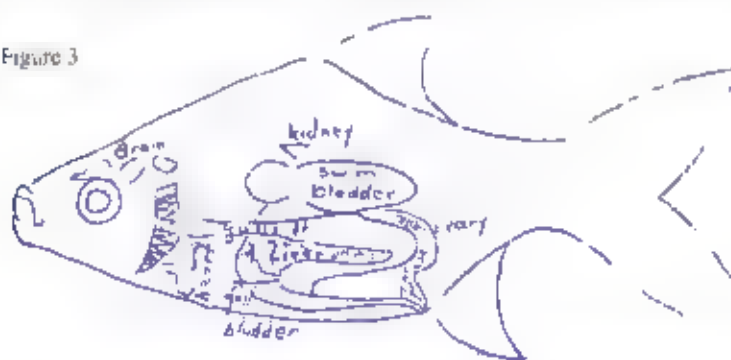
The lower illustration shows how to open the skull.

Here in Germany we have our annual experience in dissection of fishes. For New Year's there is the big carp to butcher and this gives us fine experience for the same task with aquarium fishes. When you start examining the fish keep in mind that the internal arrangement may vary. For instance some fish have no swim bladder and you'd be wasting your time looking for it. To find some of the organs can be a kind of a hide-and-seek game, but if you are patient, you'll find your way. The inexperienced and hasty aquarist will find only many strands.

Since you need to know what healthy intestines look like, you can gain experience by helping your wife clean fish for eating. My wife is thankful for my help and I learned much about the insides of fish.

I recall once when she was getting ready to throw some herring ~~intestines~~ out, that I found a nice example of hermaphroditism in fish. There existing side by side were both eggs and sperm.

Figure 3



A simplified guide to the basic locality of some of the important organs of a fish.

## GOING FURTHER - The Tail Burn Syndrome

by Andrew W. Hub

The July *Guppy Roundtable* contains an article by J. & J. Parrott, which discusses an unnamed disease which is characterized by a "red line" appearing on the caudals of guppies. This malady seems to be what is called tail burn, since the symptoms are identical to those described. The afflicted fish, usually a prime show male, exhibits a red line which runs down the entire back edge of the caudal. This line can be either red or reddish brown and resembles the color of burning cigarette paper. Following the appearance of the reddish hue, the caudal begins to disintegrate.

Tail burn is not some type of fungus or tail rot, but rather it is caused by environmental changes. The previous article comes close to pinpointing its origin by explaining that it appears immediately after a weekly water change, particularly in the winter. The newly added water is usually much harder than that already in the tanks. In addition, the PH of the new water is often higher than the PH of the established tank. Coupled with the PH and DH differences is the problem of temperature. The clean water may be much warmer than the tank temperature. For example, a 25% water change could cause a sharp temperature drop of up to four degrees, which is disastrous to the show male nearing his prime. The combination of these environmental shock factors: PH, hardness, and temperature produce tail burn.

Perhaps even more important than cause, is how to treat tail burn. At this point, I would like to suggest a different method. It has been my experience that tail burn seldom attacks just a few fish, but instead is found on all the fish in a particular tank. Therefore, the method proposed by the previous article may be impractical from the standpoint of time since it involves treating each fish individually.

Shortly after moving to Kentucky from the East Coast, tail burn attacked my males every time the water was changed. I found that the malady could be checked by using a product called "R.D. ALL." Just two drops per gallon as directed and a whole tank full of fish seem to clear up. Sometimes it took two applications 24 hours apart to completely eliminate stubborn cases. If the local aquarium shop does not carry "R.D. ALL," it may be obtained by writing directly to the ARSAN Research Company which advertises in *Tropical Fish Hobbyist*.

After the immediate concern of treating afflicted fish, my next thoughts moved toward preventing the further appearance of the problem. Through experimentation, I found that the answer was quite simple. Water was changed twice a week instead of once a week as before. This did not permit the tanks to become as soft and acid as before. Thus the PH and hardness differences between clean water and tank water were lessened. As a result, instead of replacing 25%-30% of the water each change, I cut back to only 20% at a time.

Some readers may not have the time to change water twice a week. These people might try removing their regular percentage of water as before, but only immediately replace half the amount removed. Then several hours later, the remainder of the clean water could be added. This would tend to cut down on the initial shock which seems to bring about tail burn.

## SODIUM BICARBONATE

by Peter Tedesco

Do you know that this powder has many uses? Some have not yet been discovered. As you know that our water has been of bad quality. If it keeps raining it will get better. We have all had our problems with our fish on account of the water and bacteria in it. If you did not realize algae does breed bacteria.

There is good algae (green) and bad algae (brown or grayish). The latter is very harmful to fish as well as humans if eaten. Some algae can be very contagious to the aquarium. This is where the baking soda plays an important part in doing a lot of things you might not realize.

Did you ever read the side labels of this powder's side box. I slowed down on my use of baking soda and noticed a little change in my fish. I thought maybe the salt should be increased. No, instead I went back to the baking soda and it perked them right up. Baking soda has the ability to absorb almost any gas in the atmosphere as well as improve water quality. In water you have ammonia which is an acid and is toxic - one good, the other bad. But carbon dioxide and carbon monoxide is absorbed in the water from outside as well as the build up in the water. Plants do help also to take in carbon dioxide and release oxygen.

If you smoke in your fish room or have a space heater, the water absorbs the unburned vapors of gas. Even if you put a fan pan in the fish room and empty a box of baking soda into it, it will be good for a couple of months and help the air quality. That's why I went back to using baking soda. I add it to my tanks at least once every two weeks without fail. Every week would not even hurt. It will not harm the fish at all. And you would be surprised that it even improves the water for plant growth as well as keeping the water crystal clear. It has a very wide range of uses. I'm still researching on this. All information is important. Always willing to help and improve the quality and the environment of our little animal friends. You keep them healthy and happy and they will reward you 100 fold. Grow that special show winner for next year's show. Good luck to all!

## ANSWERS TO QUESTION OF THE MONTH

### February Question - Cause & Cure of Split Tails and Tail Rot

#### Tail Rot, by Warren Burke

#1. Let's look into the temperature of the weather that we've been having in the past few weeks. Most of us in the Eastern and Western areas, the temperature fell way below freezing. For one thing you must not let the temperature in your tanks fall below 72 to 74 degrees. This causes stress in all fish. Ich, fungus and velvet disease will follow after the fish are in stress. There are several methods to cure these problems.

1) is using Penicillin capsule form. In doing so, you use one capsule of Penicillin to each 10 - 20 gallons of water. Raise the temperature in tanks to 82 degrees. Take out all filters and replace with sponges for at least 5 days. Then gradually change the water of 25% by siphoning from the bottom of your tanks. This counts for all fish that are stricken with these symptoms. I would also use a straight razor to trim no more than 1/8th of an inch. This way you are removing the dead portion of the bottom of the tail, and eliminate extra spreading. If it is only one or two fish involved isolate them and place in a tank of 5 1/2 gallon size with only half of a capsule of Penicillin. Penicillin is easy to purchase in any drug store - no prescription needed. This is the best remedy for Tail Rot and Velvet disease and Fungus. Also when you make a cut in the tail always cut straight down - not across - to cause a split in the caudal fin. Then if you have on hand some mercurichrome with a swab of cotton, use this on cut.

#### Tail Splits, by Warren Burke

Tail Splits can be caused by many things. In how you net and handle your fish, a swift aeration flow of air pressure, Vitamin B-12 placed directly into your aquarium doesn't do any good, because you are only getting to the surface of the scales of your fish and not benefiting anything. Vitamin B-12 must be taken internally into the fish like all vitamins. When I use Vitamin B-12, I place it along with other vitamins in a microworm culture. So when the worms are given to your fish they are getting their vitamins internally. Your benefiting not only in raising the worms to their best, but also your fish are benefiting from the vitamins that are taken internally. So you see when placing vitamins for your fish use microworms with any vitamins used. This is the only way in giving your fish the vitamins that are needed.

#### Vitamin B-12, by Astrid Young

If you want to use Vitamin B-12, feed the Japanese Water-flea Moina macrocarpa once a day. This water-flea is easy to raise in small tanks (18 liters) in your fish room. For fast breeding feed only baker's yeast, which is rich in Vitamin B and special algae. Scenedesmus or Chlorella. On the third or fourth day of their life, each water-flea have 15-30 youngsters, small enough to feed baby guppies. The others may be fed to adult guppies. If you do feed the water-flea only with yeast don't forget to feed your guppies once more with food rich in vegetable content.

The following answer was taken from an article in the Fancy Guppy Correspondence Club (February 1970). Only portions of the article have been used in order to add to the above comments.

#### A Word on Split-Tailed Guppies, by George McCroskey

Split tails are usually quite a different ailment than the problem known as "ragged" tail or fraying of the trailing caudal area. What makes both troubles so hard to cure is the fact, that it may be one cause that does the damage - or more often, several causes all occurring at the same time. While prevention of the two troubles is by far the best way known to date, it is often too late to diagnose potential trouble when it already has happened - usually shown by a tank of mixed mature or semi-mature guppies.

The very basic root of most split tails can be said to be based on two things, roughly speaking:

- 1) An upsurge in the amount and kind of bacteria in a tank
- 2) a radical change in the water composition and this can be either of both: a water hardness change, or an acid-alkaline or pH change. There are other possibilities when one is talking about frayed tails, but these are genetic in most cases and are an entirely different matter.

A frustrating further aspect of this problem is that some specific strains of guppies will split their tails for no other cause than it is difficult to really prevent it. BUT, these same strains will often regrow the split - such a short time (often overnight) that it can be said to be a minimal problem. I can theorize that the kind of water used with the fish has a great bearing, but as far as I know, no one has researched this idea. Regardless, people with such strains of guppies do take precautions and use certain methods when split tails are seen in a tank. For what it is worth, here is the method:

Lower the depth of water in the tank - less than six inches if the tank is large or is deep.

Add a water-disinfectant to drop the bacterial content. The most often used medicant is acriflavine, enough of a stock mixture used to slightly color the water yellow-green.

Heavily use amounts of Vitamin B-12. One 25mg tablet per five gallons of water added once a day.

Feed ONLY a high-protein dry food - lightly and often.

Change filter media once each day - but keep water agitation to a minimum.

Treatment as described is used until tanks begin to heal — usually no longer than three days. After this period of time, tank water levels can be resumed BUT make absolutely certain the new water is identical to that normally used. Frequent testing needed.

If a tank of guppies begins to show early signs of ragged tails, often appearing only in a single male individual, some precautions are in order immediately. If your water is somewhat hard and alkaline, the most recommended cure is the use of formaldehyde (formalin). Use the solution of 30-40% strength, add two drops per gallon of tank water. If the tank contains old water, the active formalin in the solution will dissipate in from three to five days. **AFTER** the maximum time has elapsed, a second dosage can be added **IF CONDITIONS SEEM TO WARRANT IT**. This can be assumed to be so, if no improvement in the guppies can be seen and more fraying of tails is observed. As formaldehyde is a potent, heavier dosage may be harmful, and this can be dangerous to the fish if second dosages are added too soon after the first.

While acriflavine can be substituted for formalin, in some water makeup, this will cause temporary sterility of the treated fish. Methylene green is also a potent disinfectant BUT also can be detrimental to guppies if the water has certain dissolved minerals, or is somewhat soft and lacking in minerals of certain kinds that tend to dilute the effects of the medicine.

I have noticed certain conditions in my own tanks, that will cause spots to tank very quickly. If the tank contains old water that is a bit acid, the siphoning of the bottom and adding of new water in too much quantity will cause the problem in a matter of hours. Yet when the same new water is added in quantity as less than one fourth the tank volume, no harm occurs and the fish seem to benefit by it. I have learned that the apparent change of the water PH, in any great amount does the damage, even though the change may be extremely small. It is my opinion that once one has a large number of large and old male guppies, automatic use of some sort of water disinfection, will go far to prevent the above troubles — especially with show guppies.

## A SURE CURE FOR FISH DISEASES

by B. J. Burgstaller

Now, before you become "hyper" and look for the name of new miracle drug, or a major breakthrough in aquarium techniques, permit me to state that what I am speaking about is **NOT** new, is **NOT** a drug or **ANY** type of medication, for that matter, but, instead, is plain old everyday, **COMMON SENSE** and **DEDICATION**. In fact, you might call what I am speaking about as Nature's way of caring for her children, your fish. Better still — let's call it a fish's way of curing itself with a helping hand from its keeper **YOU**.

Through the years, many people have gone on a so-called "Back to Nature" kick, that is, healthy foods free from fertilizers and preservatives, various exercise programs, vitamins, Yoga, R.S.T., meditation, etc., all in the hopes of living healthier, happier lives. The majority of these programs have one thing in common, in my opinion, they successfully utilize the body's natural processes of fighting disease and other stresses, or strengthening its natural immunity processes. Let's face it, if we all lived somewhat healthier lifestyles, we would not be as prone to the many diseases and other complaints that have plagued mankind for centuries. Well, why not the same with our fish? Instead of relying on the dozens of medications most of us keep in our fish room, we **SHOULD** be concerned with correcting the **CAUSES** of these problems, before they manage to infect our prized fish and aquaria.

When was the last time that you performed a partial water change? How many varieties of food do you offer your fish on a regular basis? Do you ever utilize non-iodized or Kosher salt in your aquariums?

Does your temperature fluctuate 10 degrees or so every day? When was the last time that you cleaned your filters? Are your filtration systems above or below average? Were your last purchases properly quarantined before introduction into your community aquarium? Do you utilize the many types of vitamin supplements available for your fish? All of these questions should be answered honestly and no-holds-barred on your excuses for **NOT** living up to your part of the bargain. Were they really important, or did you just not feel like it?

Let us take a good look at some of the diseases, the more common ones, that we have all experienced and see just what we **COULD** have done to prevent their conception. Ich, for example, is usually caused by severe temperature fluctuations coupled with sloppy aquarium conditions, and many cases, fish are already infested with the parasite, but their amazing pricelessness manage to keep it under control or in a dormant state. The fish is placed in its new home and **WHAMO**! Those insidious little white specks appear and proceed to infect any fish that they can get a hold on. Many things could have been done to prevent this outbreak. Was the temperature of the tank stable? Was the water low in organic wastes? Was the fish properly quarantined before introduction? Were the fish being offered a healthy balanced diet? Ask yourself these questions and, above all, **Be Honest With Your Answer!**

Shimmies, the bane of all Monday enthusiasts, is caused by chills. Is your heater operating properly? Is it the right size for the tank? **Be Honest With Your Answer!**

Various fin and skin diseases caused by bacteria are the direct result of poor water conditions. Have you been overfeeding? Have you kept up with your partial water changes? Are your filters cleaned regularly? Are your tanks properly filtered, that is, are they fillers the correct capacity for the particular tank? **DO** you ever utilize salt on a regular basis? **Be Honest With Your Answer!**

**NOW**, did you realize that **ALL** of these problems could have been prevented by you and did you also realize that they could have been cured **BY THE FISH THEMSELVES**? In many cases, they can. A fish's natural immunity is the direct result of its cure under aquarium conditions. If its home is healthy and stable, the fish will be healthy and its natural immunity will be at their peak. They will not be as prone to these problems if they're in a healthy state and this depends on **YOU**, the hobbyist. Many of the normal, run-of-the-mill maintenance chores can be critical in the overall well-being of your fish. Stable temperature, partial water changes, clean filters operating at their full capacity, proper care and consistent air feedings all make up a stable environment, free from the stress that cause many problems.

*Reprint - The Glades* (This paper originally appeared in "The Progressive Fish-Culturist" (U.S.A.) and is reprinted here, slightly abridged, from Pet Fish Monthly (London) — we got it from the February issue of the GUPPY GAZETTE



## A REVIEW OF METHODS TO CONTROL ICHTHYOPHTHIRIASIS

By D. G. CROSS

*Salmon and Freshwater Fisheries Laboratory, Ministry of Agriculture, Fisheries and Food*

**ICHTHYOPHTHIRIASIS**, or white-spot disease, of freshwater fishes of temperate and tropical waters is caused by the ciliate protozoan, *Ichthyophthirius multifiliis*. The adult parasite lives between the epidermis and cutis of the host fish and feeds on damaged host tissue and body fluids. A proliferation of the epidermal cells in the region of the infestation gives rise to the "white-spot" by which the disease is recognised. The mature parasite leaves the host and sinks to the water bottom where it secretes a soft jelly-like covering. The parasite then undergoes rapid division and can produce up to 2000 young. When reproduction is completed, the young parasites are liberated from the cyst and swim in search of a new host. The timing of the different stages in the life cycle is dependent on water temperature: as an example, at 8° to 20°C the encysted stage lasts approximately 24 hours, the mature young parasite remains viable for 48 hours, and the stage within the host takes from 1 to 3 weeks to reach maturity.

The Salmon and Freshwater Fisheries Laboratory maintains small stocks of fish for experimental purposes. These fish have been periodically subjected to outbreaks of ichthyophthiriasis. The primary method of control has included the use of methylene blue for a 3-week period, but it must be started early. This treatment affects the feeding habits of the fish and results in poor quality fish. The search for an alternative method of treatment included an extensive review of the literature, supplemented by personal experience.

### FINDINGS

**Paraffin oil and sodium carbonate.** The literature stresses the fact that few, if any, of the eradication techniques have a direct effect on the parasite while embedded in the host. This stage of the parasite is unaffected by externally applied reagents, and thus it is difficult to see how such treatments as wiping the surface of the fish with paraffin oil and dipping the infected fish in a saturated sodium carbonate solution can be effective. All of the efficacious treatments appear to act on the free-living stages of the parasite and thus have to be applied for a sufficient time for all of the parasites, on the host to have passed to the free-living stage.

**Temperature.** Increasing the temperature to 30° to 33°C as a control technique is unsuitable for most coldwater fish; however, the periodic raising and lowering of water temperature can be beneficial. Caution should be used with this method since rapid temperature changes can cause mortality. Increasing the temperature within the tolerance range of the fish reduces the time required for a complete life cycle. This in turn reduces the treatment time required to eliminate the parasite.

**Salt.** The use of common salt is one of the recommended treatments. Different authors recommend concentrations of sea salt, sodium chloride, or a mixture of sodium chloride and magnesium chloride. The use of salt in aquariums with mesh floors and no water flow is a unique control technique. A high salt concentration can be maintained under the mesh floor while the fish remain in a lower concentration. Parasites emerging from the host crawl on the tank floor where they are killed by the salt concentration. Personal experience with the use of salt has shown that it is not the parasite that it has been considered to be. The treatment did not eradicate the parasite, however, it may be beneficial in reducing the osmotic stress imposed by the presence of open wounds.

**Methylene blue.** One of the most frequently recommended methods of treatment is the use of 1.5 g/l (1.5 grams per litre (9 p.p.m.)) of methylene blue. The main advantages of this treatment are low toxicity and cost. The fact that it is inactivated by organic detritus can be overcome by increasing the dosage without

harming the fish. The disadvantages of this treatment include poor quality of the fish after treatment, difficulty in assessing progress of the treatment, and some strains of Ich seem to be more resistant than others.

**Acriflavine.** Hickling and Schapereau's recommend the use of acriflavine (trypanflavine) at a concentration of 0 mg/litre (10 p.p.m.). Personal experience indicates that this method is satisfactory for treating most outbreaks of the disease, though occasionally some fish respond very poorly to the treatment. Van Duyn contends that acriflavine causes temporary sterility and possibly genetic aberrations in fish, therefore, it should be used with caution.

**Penicillin (ale).** This antibiotic has been reported to be effective against *I. multifiliis*. However, it is known to act against Gram-negative bacteria through their distinctive cell wall structure and it is difficult to imagine how it could combat a protozoan infection. It may be that the beneficial effect noted is due to the effect penicillin has on secondary bacterial infections although most of the bacteria pathogenic to fish are Gram-negative and resistant to penicillin.

**Quinine.** At a concentration of 0 mg/litre (10 p.p.m.) quinine has been proposed as a treatment of ichthyophthiriasis. The recommended treatment was raised to 30 mg/litre; however, this concentration is toxic to some fish. Van Duyn reports that the compound is more effective at pH 6.5 and recommends an adjustment of pH to this value. Further he advises that the concentration should be built up by the addition of three equal doses at 12-hour intervals. This reagent has one of the same defects as methylene blue in that it is inactivated by organic detritus, but unlike methylene blue, overdosing with quinine is dangerous because of the smaller differential between its toxicity to the parasite and fish. Experience has shown that the treatment must be extended for at least 24 days to ensure complete eradication of the parasite. At the end of this treatment the fish tend to be in poor condition.

**Mepacrine.** Slater used mepacrine hydrochloride (quinarine hydrochloride) at a concentration of 1 mg/litre (3 p.p.m.) for the eradication of persistent cases of ichthyophthiriasis. This reagent is much more toxic than quinine; therefore, Van Duyn recommends that it should be used only for cases which do not respond to other treatments.

**Malachite green.** Allison had success with concentrations of 0.05 to 0.10 mg/litre and this treatment is used by many in the United States. A charter found that the toxicity threshold concentration to harlequin is 0.11 mg/litre. Although the harlequin is sensitive to malachite it is apparent that great care must be exercised if the oxalate formulation is used as an extended treatment. Alabaster also reported that the threshold concentration of the zinc chloride formulation of malachite green to harlequin is 0.06 mg/litre. Therefore, if malachite green is used it is essential to know the formulation. The difference in parasite and fish toxicity is much too small to recommend either formulation without qualification.

**Mercury compounds.** Bucher mentions the use of mercurochrome for controlling white spot, but fails to state the concentration. Van Duyn describes the use of mercurochrome at a concentration of 1 mg/litre, but advises against it because of delayed mortalities resulting from its use. Our experience is that 1 mg/litre is an effective concentration, but the fish require careful attention after the completion of the treatment to restore them to good condition. Two other mercury compounds have been used against ichthyophthiriasis, pyridyl mercuric acetate and mercurous chromate. Van Ham and Katz showed that 0.14 mg/litre pyridyl mercuric acetate was beneficial to the health of the fish but that a concentration of above 0.5 mg/litre was toxic to fish. Rodgers et al. showed that concentrations tolerated by fish varied with species and size. The toxicity of most chromates varies widely with the species, pH and hardness of the water and thus the use of mercurous chromate is not advised for the control of white-spot disease.

**Formalin.** Various authors refer to the use of formalin at concentrations between 100 and 250 mg/litres/litre as a short-term bath, but these methods are not completely effective, as the higher concentrations cause some risk to heavily parasitized fish and require the handling of fish with the subsequent risk of mechanical damage. Allison reports that the application of 5 mg/litres of formalin/litre every other day controls ichthyophthiriasis usually in 5 to 7 days. However, Hoffman warns that oxygen depletion may result during warm weather if the formalin kills algae and Van Duijn advises against the use of formalin solutions below 8°C because of detrimental effects to the mucous coat.

**Copper sulphate.** It has been used to control external parasites of fish. Amacher and Meyer report that 1.5 and 0.5 mg/litre respectively have been used successfully against ichthyophthiriasis but care has to be taken especially in soft water since these concentrations are close to the maximum tolerated by many fish species.

**Chloramine-T.** It is reported to be effective against white-spot disease and is used by aquaria in a number of countries for this purpose. However, Van Duijn does not recommend its use because it is absorbed by organic detritus and forms toxic compounds with metals. Sterba advises against its use because the toxicity varies with the hardness of the water. It has been shown by Cross and Hursey that contact with metals commonly encountered in fisheries management does not adversely affect the toxicity to fish and that, provided the hardness and more important, the pH of water is known, it is possible to recommend a dosage, efficacious in eradicating the parasite. Its general antiseptic properties make it efficient against many of the secondary infections encountered.

**Trichlorinated phenols.** Bourder states that a mixture of trichlorinated phenols, marketed in Britain under the trade name TCP, may be used against *I. multifiliis*. However, it seems, but there are better reasons, objectionable from the consideration of both effectiveness and cost.

**Mixtures of chemicals.** While a paper has dealt with a number of remedies involving the simultaneous use of one chemical alone, no attempt will be made to discuss methods involving mixtures of chemicals. However, it should be noted that many mixtures have been proposed, but that with the possible exception of the mixture of formalin and malachite green generally these methods are too expensive for large scale application and have met with failure due to the greatly increased toxicity of the resultant mixtures.

The table on the next page summarizes the advantages and disadvantages of the different remedies for ichthyophthiriasis. The merits of the methods have been assessed on the following criteria:

1. The efficiency of the method. The method should eradicate the parasite and at the end of the treatment the fish should be in good condition.
2. The practicability of the method. In this category is included the cost of the reagents, labor and equipment, and the facilities required.
3. An assessment of the degree of airside between a concentration controlling the disease and a concentration causing fish mortality — the therapeutic index.

The choice of a method to control ichthyophthiriasis seems to lie between methylene blue, formalin, and chloramine-T (see table). Considering all of the factors discussed, chloramine-T seems to be the best treatment available, providing the water hardness and pH value are known. Chloramine-T has been used by this laboratory for 3 years and has proved effective against all but very advanced cases of white-spot disease.

## Assessment of Methods of Eradicating Ichthyophthiriasis

Method	Efficiency	Practicality-Reliability	Therapeutic Index	Remarks
Chloramine-T	Good	Good	Moderate	A good method if pH and hardness are known.
Methylene Blue	Good	Moderate	Good	Fish condition may deteriorate.
Formalin	Good	Good	Moderate	Should not be used in low temperature areas.
Quinine	Good	Moderate	Moderate	Fish in poor condition after treatment.
TCP	Moderate	Good	Moderate	Not totally effective.
Malachite green	Moderate	Good	Poor	Affects feeding habit.
Mercurichrome	Moderate	Moderate	Poor	Long term mortality may result.
Acriflavine (crystaline)	Moderate	Good	Moderate	May cause temporary sterility.
Mepacrine (quinacrine)	Moderate	Moderate	Poor	Use only in stubborn cases.
Copper Sulphate	Moderate	Good	Poor	Requires knowledge of water quality.
Penicillin	Moderate	Poor	Good	Doubt as to effectiveness.
Heat	Poor	Moderate		Not effective as sole agent.
Sea Salt	Poor	Good	Moderate	Not effective.
Common Salt (sodium chloride)	Poor	Good	Moderate	Not effective.
Mercury Compounds	Poor	Moderate	Poor	Long term mortalities may result.

## HOW TO HANDLE FINROT IN YOUR GUPPY TANKS

by James Atgeron

Finrot is caused by a combination of things. In order to control or eliminate the problem we must attack it from several angles. One can change the fish's environment and/or change the fish.

There are several things that we can do to the fish's environment, which will help keep down the incidence of finrot.

1. **Reduce the number of fish per gallon of water.** This will decrease the amount of food fed and reduce bacterial numbers. With reduced numbers of fish, the fish are less likely to nip at each other's fins and cause damage which may act as a focus for the infection of finrot.
2. **Feed only 2-4 hours daily** preferably with live foods. The excess food serves as a perfect medium for bacterial proliferation. There is a lot less waste with live foods.
3. **Reduce the water temperature to 72-74° BEFORE your fish develop finrot.** Once they have it, decreasing the temperature doesn't seem to help a lot.
4. **Do not treat the water with antibiotics.** This does not give the fish adequate blood levels of the drug to combat the bacteria. The problem must be treated from the inside out. If you are going to use antibiotics, use fish foods impregnated with them. Chloramphenicol is probably the best drug followed by tetracycline.
5. **Make small water-changes 10-15%.** This will reduce shock to your fish. Adding some salt to the water will help protect against shock and may decrease the numbers of certain bacteria.

Changing your strain of fish to that they are not as susceptible to finrot will give better results than changing the fish's environment.

1. **Increase the resistance of your fish to disease.** Provide environmental conditions are optimal, changing the genetics of your guppies is the best way to increase resistance to disease. Inbreeding is the best way to fix a strain and also the surest way to decrease resistance. So try outcrossing your fish. This may also all but eliminate the problem. You may want to keep your stock pure. If so, then cull those fish which develop finrot early. Usually those fish that develop finrot early are the ones with large fins and small bodies and you don't need them anyway. Even in the batch of males that develop terrible finrot, there are usually a couple that are spared. If these fish aren't too terrible in terms of finnage, color, size, etc., then use these fish for breeding (don't breed them to their sisters, breed them to their cousins or outcross them).

In summary, finrot is not an unsolvable problem, but there is not one treatment or drug that will prevent it. It must be treated as a multifactorial disease. We attempt to change as many factors as we can that predispose the fish to the disease. Only then will satisfactory results be realized.

## BRINGING IT ALL TOGETHER

### Subject: Treating Your Fish

Following are two recent articles that appeared about the use and effectiveness of drugs used to treat fish. Between the two of them they pretty well cover the field and should serve as a good source of reference on this difficult to find subject. The third goes into treatment without using drugs.

## DRUGS AND YOUR FISH

by Dr. Terry Doyle

This article was inspired by a recent paper I came across in scientific literature entitled "Inadequacy of Aquarium Antibacterial Formulations for the Inhibition of Potential Pathogens of Freshwater Fish" by J. J. Trust, *Journal Fisheries Research Board of Canada* 29: (10), 1425-1430 (1972).

Being by profession a chemist working on antibiotics and a hobbyist working with fish, this article naturally caught my eye.

Dr. Trust has tested 14 products, which are claimed by the manufacturers to be useful in the cure or prevention of aquarium bacterial or fungal diseases. These products were tested against a number of bacteria known to cause disease in fish. The tests were carried out IN VITRO first, (meaning, not while the organism is infecting a host species). Following this, the products were tested in aquaria holding fish (either guppies or goldfish).

When tested, using the manufacturer's recommended dilution, NONE of the products inhibited the growth of bacteria. At higher concentrations a few of the products were bactericidal, however the effective concentrations were from 50 to 45,000 times more concentrated than the manufacturer's recommended dosage. Two of the products were toxic to fish at dosages only twice the manufacturer's recommended dosage. In some cases the 'active' ingredients were not specified by the Manufacturer, some were single entity products, and some were combination products. The active ingredients which were listed were Methylene Green, Methylene Blue, Act Flavine (and related acidine dyes), Quinine Sulfate, Formaldehyde, Sulfonamides, Potassium Permanganate, Silver Oxide.

In no case was the Manufacturer's claim concerning their product's usefulness as agents for the treatment of bacterial or fungicidal diseases of fish borne out. That is not to say that these products do not have their uses. I have used several of them successfully, but only for the treatment of external parasitic diseases, such as Ich and velvet. I have found Methylene Green preparation especially useful for these diseases.

All of this serves to point out the dilemma faced by the aquarist with a disease problem on his hands. Obviously the recommendations of the manufacturers are to be taken with a grain of salt (yes, a whole mountain full). The first problem is one of DIAGNOSIS - if you don't know what it is, you cannot treat it rationally. Generally speaking, from the hobbyist's point of view, fish diseases can be divided into two broad categories: INTERNAL and EXTERNAL.

EXTERNAL diseases are more readily diagnosed (e.g. ICH, VELVET, TAILROT, FLUKE, etc.) and are easily susceptible to treatment using some of the products mentioned before. I have used Act Flavine for fungus, Methylene Green for velvet and Silver Oxide preparations for Ich with good success. For most of these external parasitic diseases, prevention is the best cure. Like *Nothobranchius* maintained in water containing one teaspoon of non-iodized salt per million only rarely contract velvet.

The **INTERNAL** bacterial diseases are another problem. It is almost impossible for the amateur who is not a microbiologist to diagnose these diseases. The symptoms displayed by many fish suffering internal disorders are common to a number of bacterial, protozoan (parasitic) or fungal species, e.g. to say a fish has dropsy does not necessarily identify the causative organism, though it may limit the choices.

Thus, the first thing to be done when one has a sick fish, is to try to identify the cause. Begin by isolating the fish(es). Then do an external examination for parasites (small white spots in the case of ich. These are the encysted form of the parasite and are usually slightly raised from the body of the fish. Velvet manifests itself as a golden dust on the fish's body, usually starting in the scales between the eyes. Pay particular attention to the gills. Distended gills or rapid breathing are signs of gill parasites or heavy metal poisoning (copper, zinc, etc.). It may be necessary to sacrifice one of the affected fish to identify gill parasites. If no signs of external diseases can be found, both fish and aquarist are in trouble. By the time most internal diseases manifest themselves, it is usually too late. Personally, unless the fish is either rare, expensive or an old friend, my practice is to destroy it and ~~continue~~ the work.

If you do decide to treat the fish, a number of problems arise. If the causative organism is known, the problem becomes relatively easy (but only relatively) since the correct drug must be chosen at the onset of treatment. In the vast majority of cases the infecting organism is not known or even its nature, be it bacteria, virus, protozoan or fungal. At this point a number of problems must be faced:

1. Which drug is to be tried?
2. How is it to be administered?
3. How much is to be given?

Over the past half century the treatment of disease has been greatly helped by the discovery of the antibiotics. These may be divided into several classes. For the sake of brevity only a few of the more common ones will be listed here:

- A. SULFA DRUGS** - A number of members of this family of drugs have been used for the treatment of fish diseases, e.g. SULFANILAMIDE, SULFAMETHAZINE and SULFATHIAZOLE. They are used mostly in the treatment of fungus and tail rot, both external diseases.
- B. PENICILLIN and CEPHALOSPORINS** - These are perhaps the most widely used antibiotics in human medicine and are of low toxicity (it is difficult to overdose), however their cost (especially Cephalosporins) and instability in the aquarium preclude their use.
- C. TETRACYCLINES** - These are probably the ideal candidates for the treatment of fish infections. They are inexpensive, non-toxic and have a broad spectrum of activities. Their water property is very important in view of the fact that the causative organism is unknown in most cases.
- D. OTHERS** - A number of other antibiotics have been used to treat fish diseases, among them CHLORAMPHENICOL, ERYTHROMYCIN and STREPTOMYCIN, all of which suffer from disadvantages such as toxicity.

The question of how the drug is to be administered is of utmost importance. To quote Dr. Trust:

"The most convenient method of use of these formulations and that recommended by the manufacturers, is the addition of the formulation to the aquarium water. There is little evidence, however, that this method has proved effective for systemic infections of fish. Treatment of such infections generally requires that the antibacterial compounds be administered orally or parenterally.

In other words, if you have a headache you don't take a bath in aspirin. Probably the most convenient manner of administering a drug orally is in the food. This brings us back to the question of how much to give. All drug therapy contains an element of risk. The risk is balanced by the potential usefulness of the drug and the danger from the disease, e.g. if a drug kills one patient in four but cures three who would have died anyway, the risk may be acceptable. The ratio of the amount of drug to kill the patient and that required to cure him is the therapeutic ratio, the higher the number the safer the drug.

With some antibiotics this ratio is low and their use is risky unless you are looking for a new way to kill fish. Tetracyclines are relatively safe to use. The amount to be used would depend on the size of the fish, method of administration and the organisms to be eliminated. The pet industry could do the hobbyist a real favor by marketing antibiotics as a food additive and determining the correct dosage. As they are now sold for aquarist use, they are next to useless (internal v.).

Little data is available to the hobbyist on proper dosages. Usually Tetracycline is sold to be used at a rate of 50 mg./gal. in the aquarium water. How much of this is absorbed by the fish through the gills or gut is open to question. The aquarist who wishes to treat his fish rationally faces a research problem. Personally

would be inclined to soak a bit of flake food in a concentrated solution of Tetracycline before feeding or to blend specific concentrations of drugs into my prepared foods and experiment. Should anyone decide to try this, be sure to keep records such as 250 mg. Tetracycline/pound, etc.) I would be inclined to start at such a dosage and work up until an effective level was reached.

I realize this article has probably posed more questions than it has answered, but I hope it will inspire some new ideas to experiment. Bore water may make you feel better, but I very much doubt if it does anything for your fish. (from "The Bulletin", Montreal, Canada).

## WHITE MALADY (ALSO WHITE SLIME OR SADDLE BACK)

by Alex Brown

These three names are all related to a disease that all guppy breeders encounter sooner or later. They are all related. First, let me go into a little detail.

Guppies are fabulous eaters. They will eat almost anything fed to them. When they eat too much protein in their diets, this is where we will encounter White Malady.

I find when I feed heavily of freshly hatched brine shrimp, I will see a loss of color first on females, then a shallow, hollow-bodied effect, unless near, refusing to accept any foods, then death. This effect on males is not so prevalent as on females. A few males will tend to look very thin and shallow, but basically you can tell, first when you are about to be hit with this disease by watching the females.

There is, to my knowledge, no sure cure. But I will deal with prevention and what to do when you see this malady and what to do to keep from destroying all your guppies.

1. It is easy to feed more brine shrimp than is good for the guppy. They thrive on it when young and without baby brine shrimp you will never achieve size.
2. Feed until you are sure you haven't as yet acquired the White Malady disease.
3. Balance all feeding by first feeding a good dry flake food, or a blend of different foods. Follow each feeding with a green flake or dry food, dehydrated spinach. I use Mollie flakes to balance my focus.

4. When first you see your guppy appearing shallow, swimming near the top, body color faded to a very light gray. Stop all feeding of live foods, right away I mean ALL LIVE FOODS
5. Next, net out all guppies which appear in this condition and pitch them out. If you wish place them in an extra aquarium and try to treat them. The treatments will be very expensive, and I doubt many hobbyists will spend this amount of money for a cure, but I am sure someone will.

Start feeding your remaining guppies no more than 3 times daily. Watch very carefully for addition of guppy victims. Water changes have been suggested, but I have not had any luck once the disease was sighted in the aquarium.

This disease will hit guppies at 2 months to 4 months old. If you can raise your guppies beyond this point, I have every reason to believe you will not incur this deadly disease.

I have one final idea I have been using. I separate all males and females. I feed my males brine shrimp quite freely, my females once a week. I buy once feeding of females with frozen brine shrimp and a good dry food mixture. (From "The Darter" March 1974)

## THE FIN BUILDER

by John Stanton, Everglades Aqu. Soc. March, 1974

How many of us, at one time or another, have had fish which seem to be very sluggish, or, just before you are ready to show a specimen, a few fins are frayed or split? The answer for a quick recovery, or finnage that seems to heal up overnight, is vitamin B-12.

For fish with split finnage, the healing process can be as short as 3 days. I've seen guppies with large splits in the caudal, so bad that you wouldn't believe it possible to enter it in a show 4 days later. But by the time the show arrived, there wasn't a trace of the injury. The healing time is greatly reduced to this short period of time if you use B-12 continually or treat your tanks every 5 days. Use 1 cc. for every 10 gallons of water. The finnage of a fish, especially species which carry large delicate finnage, will have stronger fin rays and tissue, thus lowering the incidence of injury. The appetite and general deportment of fish is greatly improved through the continued use of this vitamin. Guppies, bettas, & goldfish, which are well endowed with finnage, are more active and will endure frequent handling. (B-12 is used on a weekly basis. A 1000mg bottle will run a little over \$5.00 at a drug store. Keep it cool when storing, although it is not necessary to refrigerate. If you do not use it on a regular basis, the healing time for injuries will take some what longer than 3 days. So don't expect miracles when you use it for the first time. Small nicks and tears can be healed in 2 days. The 1000 mg. bottle will last about 2 months with continued use for a 10 gallon aquarium. Try it and see if you can't notice the difference.

## MERETENE

### PROTEIN ... VITAMIN... MINERAL FOOD SUPPLEMENT

By Tony Tratta

Calumet Guppy Breeders Assn.

Your first question is going to be, "What is Meretene?" ...It is my answer to the high cost of brine shrimp eggs. It has all of the growth protein, nourishment, vitamins, minerals that my fish need. I have been using it for about six months, feeding four tanks with Meretene, and four tanks with brine shrimp. The growth rate between the two is unbelievable. The four tanks with brine shrimp did well, but no way came up to the fry on Meretene... I feed it along with all my other dry foods, beef heart, liver, etc. My discovery of Meretene was through my own personal need for it. I was for some time put on a very strict diet. The Doctor had me take this, a form of almost total nourishment.

Now being economical, I thought I would buy the large economy size. Needless to say I didn't need to take it that long. So one day I was sitting in my fish room and happened to think of the stuff and read the label on the can. It read like a "Guppy Survival Kit" Protein... Fat... Carbohydrate... Vitamin A... Vitamin B... Thiamine Riboflavin... Nicotin... Ascorbic Acid... Vitamin E... Pyridoxine... Vitamin B-12... Folic Acid... Iron... Calcium... Phosphorus... Iodine... Sodium... Potassium... Magnesium... Copper... Need I say more?

Meretene can be bought in any drug store for less than a small can of brine shrimp eggs. It will last longer, make no mess, will not cloud the water, and as of this date I did not lose one fish. (Try it and you will go on using it until I find something better.)

## THE EFFECTS OF K.W.K.

by Klaus Brevant

Gateway Guppy of St. Louis

This article is intended to be sincere. If it appears comical and amusing, it is not the intent of the writer.

After the November show in Milwaukee, I was all prepared to go home and have my guppies ready for the March 31 show in Chicago, 6 months hence. The first thing I did was to move all males of four to five months old into larger, more spacious 20-gallon tanks. Four 20-gallon tanks were filled with approximately 20 males each. Culling sharply, I was satisfied these were future champions.

I had been warned not to change over 25% of the water at one time, so I was very careful not to exceed this limit. I applied Dynaflo power filters, including a dirt magnet, plus an aeration pump to keep the guppies moving. I hate to see guppies hovering. A was fine. Feeding was no problem. I dumped about 20 albino cats in each tank to help clean up the uneaten food. (These albino cats were on y babies approximately 1/2 to 3/4 inches long.)

Everything was great. In one month's time I noticed a great deal of growth. Excited, I decided to remove the larger ones for fear the cats or other males would tear their beautiful caudals. Selecting six from each of the four tanks, I placed these into a 20-gallon high that was available, but unfortunately I didn't check closely enough on pH. The guppies moved beautifully for about 15 minutes. Someone called me on the phone and when I returned, well, that's right, twenty-four dead males.

At this point I was not too disturbed since I had at least sixty additional males... plenty for the show in Chicago.

Someone suggested that dipping guppies into a solution of methylene blue would help their caudals against nipping and tearing. You guess my next adventure... all sixty males, one by one, were hand-dipped into this solution. Very carefully I made sure the caudal only went into the solution... but, as everyone knows, guppies have a way of squirming, so a few went in head first.

The ones that went in head first died very short... only ten out of sixty... nothing to worry about with 50 so I left, and these are the very survivors of them all... they have survived me.

One month later, the guppies are growing great with nice full caudals... beautiful dorsals. I decided to change the normal 25% of water for the week. So very carefully I siphoned and cleaned up in general. Only two were caught in the siphon tube (They came out fine... only missing their dorsals). Still, 48 guppies is great and show time is now only two months away.

Studying my guppies I noticed a clumping of the fins. Not bad, but still when you look at your guppies day after day, you notice little things. No problem... I have all these modern scientific medications to help me, if I can only decide what is the matter... it could be ich... or some other parasite. But, no fear, the fish doctor is ready with the diagnosis. (Webster term... meaning a scientific discrimination of any kind.) If you look closely at the word 'discrimination' it contains the words 'crid' or 'crime'. Well, what I am about to relate is a crime.

Using the latest medication, tetracycline, I carefully added four 250 mg. capsules to their water, turning off all filters. I lost two males, but noticed a thin edging along their caudals. Carefully I removed 25% of the water and on the following day... 5%, and the third day... 10%. But the darkness increased.

Worried, I began a second course of treatment... I added a few drops of methylene blue per gallon. Now I could not see the fish... so I was really worried. Is the medication working? I can't tell as the tanks are so dark. I decided to change some of the water but only 25%. No good, so I can't see. The following day I changed another 25%. Better but still not good enough to see. Put on a dynaflo filter in two days the methylene blue was gone, so were 15 guppies.

Well, 29 are left in good shape and the show is only one month away.

One day I noticed one had died. Fishing him out, I noticed a bloody streak on the body. Worried, I decided to double check all the tanks. With only 28 males, I placed them all into one tank. (No reason to be up four tanks...)

Two weeks prior to the show two more died with the same symptoms. Well, we can't allow this to continue. Let the fish doctor diagnose this as flukes... treatment begins immediately. Having read all the latest treatments, I proceeded to treat the remaining guppies. Tetracycline to the rescue. Very carefully treated the 26 remaining males.

In changing water after treatment, the first 25% was not enough. So I again decided to change them into one of the other empty 20-gallon tanks. Carefully, one by one, I placed them into the new tank. I only lost two males this time... and the show is only one week off. Now to pray.

24 males left. A week before the show in Chicago, the greatest tragedy hit... the caudal region of all males was slowly being eaten away. Some had lost 1/4 of their caudals. By this time I was about to go out of my mind. I carefully placed these males into a straight solution of methylene blue, trying to check the ragged looking caudals.

After the dipping six died... only 18 left. But I cannot stop the caudal from slowly disintegrating. I picked out the worst of these, ten in all. Now only 8 left. But day after day one or two died. Until Friday

before the Chicago show I had only 3 left. Now, even if I have to walk both ways, these three guppies are going to the Chicago show!

In Chicago, Jim Pape, who was show chairman, politely greeted me when I arrived and asked, "Well, Elv, how many guppies are you entering?" "Only three", I replied. "What happened?" I'm asked. "K.W.K." was my answer. "K.W.K.? What is that?" I'm asked. "Killed with Kindness", I replied as I very carefully slipped these three guppies into their bowls... and I whistled as the girls entered my three guppies into the tank. I will make it after all. ##

## THE PROS AND CONS OF OZONE

by Stan Davis

**OZONE:** According to Funk and Wagnall, Ozone is "A blue gas with a pungent odor like that of chlorine, formed variously, as by the passage of electricity through the air, and regarded as an isotropic form of oxygen containing three atoms in the molecule, (O<sub>3</sub>). It is insoluble and is a powerful oxidizing agent."

At this time down to the fact that ozone is... 1) an oxidizing agent, 2) unstable, 3) a gas, 4) may be created by electrical discharge, etc.

**OZONE AS AN AQUARIUM AID:** Ozone is useful in the aquarium as a bactericide and disinfectant. Because ozone oxidizes or decomposes organic materials, it helps break down waste products, larvae, such as egg stages of parasites, bacteria, viruses, spores and cells with which the gas comes into direct contact.

**Bactericide:** (Classification of Bacteria: Harmful Material) It has been demonstrated that water with a bacteria count of 70,000 per milliliter will be reduced to zero in 3 minutes when the ozone concentration of water is 1.5 ppm. Ozone's real importance in controlling bacteria is not in the direct killing of bacteria, which it does to some degree, but rather the decomposition of material upon which bacteria feed... waste products, excess uneaten food, dead fish, etc. Thus the ozone controls bacteria population by oxidizing organic material before it builds up to the point where bacteria can flourish.

**Controlling Disease or Injury:** If the bacteria is limited by the use of ozone, injuries to fish will heal more rapidly because the chances of infection or fungus will be minimized.

**Sterilization of Live Food:** Passing ozone through water containing a hatch of brine shrimp or daphnia collected from a local lake for 5-30 minutes should sterilize the live food.

**Prevention of Outbreaks of Disease:** Continuous use of ozone, or regular intermittent use, should keep bacteria under control and thus prevent any outbreak of bacteria associated epidemics. Some authorities do not advocate continuous use of ozone generators or ultraviolet sterilizers, for beneficial bacteria could also be destroyed. The continuous use of the bulb-type ozone generator described in this article is not capable of producing an ozone saturation high enough to completely sterilize an aquarium. My own experience indicates that this will not happen. Excessive use of any type of ozone generator without a reactor tube can be harmful.

**QUANTITY OF OZONE:** A homemade bulb-type ozone generator will have an output of about 0.6 ppm ozone. This is just barely within effective, safe range of 0.5-1.5 ppm (Stoner 1971). Some of the commercial units are capable (electric arc type) of producing up to 500 milligrams of ozone per hour... many times more ozone than a bulb-type generator. Use of a reactor tube is necessary with arc-type generators (Ravenadale, 1967). I have run using bulb-type ozone generators continuously for several weeks in tanks ranging from 20 to 70 gallons, with no apparent harmful effects to fish or plants. As a precaution, ozone-producing airstones should be placed in the tank where fish do not swim or congregate.

Excessive ozone causes irritation of the gills. This can sometimes be seen as red discoloration of the gill plates or the fish may rub the gills on a rock or other rough surface.

#### DANGERS OF INDISCRIMINATE OR OVER-USE OF OZONE.

**Sterilization** - Although I have not read anything about this side effect, I have noticed that I have never had a successful spawning in a tank where I have been running ozone at full strength. When you think about this a moment it appears logical. If ozone will attack bacteria, etc., it could also attack sperm.

**Undergravel Filters** - Under normal circumstances the amount of ozone created by bulb-type ozonizers is insufficient to saturate the water of a 20 gallon tank, so that it will not kill the bacteria in the gravel overlying an undergravel filter, but if the circulation is reversed or ozone brought into direct contact with the bacteria, your filter will fail to function properly.

**Over Confidence** - The use of ozone is not a cure-all. It is merely an aid in maintaining a healthier aquarium. **OZONE CANNOT COMPENSATE FOR POOR AQUARIUM MANAGEMENT!**

**Affect On Growth** - Stoner (1971) reports that if the ozone level is maintained between 0.5 and 1.5 ppm the effect is negligible, "stunting growth approximately 1%".

**CONSTRUCTING AN OZONE GENERATOR:** Actual building of an ozone generator is quite simple. Parts consist of an air pump, ozone chamber, ozone bulb, socket and electrical resistance.

**Air pump** - Any good vacuum-type air pump is adequate, although some commercial ozone manufacturers recommend piston pumps. If you plan to use your ozone generator intermittently a word of caution is required. Every time you turn off your generator, pump and all the ozone will be forced back into the pump as the water in the tank moves back through the airstone and into the airline as it equalizes. If the ozone reaches the pump it will attack the rubber valves and diaphragm and ruin a good pump in a week or so. You can prevent this back flow of ozone by inserting a check valve between the ozone chamber and the pump. But most check valves have rubber or composition gaskets which will be consumed in short order. If you can find an all-metal or plastic valve, these are available, but seem to be rarely stocked, you can simply run the air pump continuously and turn on the ozone bulb as you desire. This way the pump is always forcing air through the chamber and your system will be a constant air supply which may be used as an intermittent ozonizer as desired. If you want to get fancy you can even put the ozone circuit on a timer.

**Ozone Chamber** - Mason-type glass jars with screw tops work well, but the ozone attacks the rubber seals. The jar should be as small as possible so that air being pumped through the chamber has to pass close to the ozone bulb. I use silicone sealant to lumen the socket to the lid as well as to seal around the wires and air intake tubes. I use copper tubing (3/8" O.D.) and as shown very little oxydation. If rigid plastic tubing is available, that would probably make better airtight and save the nuts etc.

**Ozone Bulb** - I use "Syvarin Germicidal Lamp Type B" (4 watts). Other bulbs by other manufacturers may be used, but may require different resistances in series with the ozone bulb.

**Socket** - The ozone bulb shown above requires a small screw type socket. Outdoor Christmas tree sockets may be used, or similar ones may be purchased.

**Electrical Resistance** - Because the ozone bulb is a 4-watt bulb it is necessary to add a resistance to the circuit. This may be accomplished in any one of several ways:

1. An electrical resistor 25 watt's fixed resistance of 400 to 425 ohms
2. 40-watt electrical light
3. 14-15-20 watt high watt transformer

I used a 40-watt bulb in my first ozone generator, but have since replaced it with an electrical resistance, making a more compact unit.

**Wiring** - The actual wiring is straight forward. The schematic shows the method I used. The pump is wired in parallel, but the Resistance and Ozone must be wired in series.

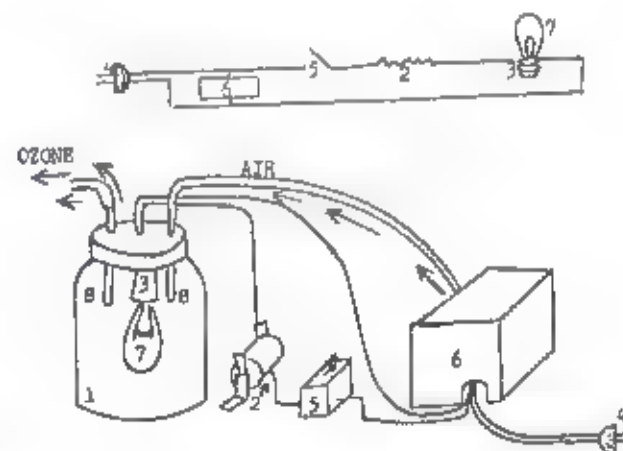
**EFFECTIVENESS OF YOUR OZONE GENERATOR** Several unassociated factors that contribute to the overall effectiveness of the bulb-type of ozone generator deserve consideration.

**Bulb Life** - Germicidal bulbs tend to lose their effectiveness with use. After 3 months efficiency seems to decrease very rapidly, so after an operating life of 4 months they should be replaced. You can test the ozone output by putting the airstone in a 2% solution of potassium iodide. The solution should change from clear to dark yellow-brown in the presence of ozone. The rate of color change is a crude measure of the effective ozone output of your generator.

**Ozone Line & Airstones** - Because ozone is unstable it will convert back to oxygen rapidly, so the airline between ozone chamber and tank should be as short as practical. The airstone is also important as the transfer of ozone to the water is directly related to the surface area of the bubbles... many small bubbles are more effective than a few large bubbles. I use only one airstone per generator.

#### OZONIZER

1. glass jar
2. resistance
3. socket
4. electric bulb
5. on-off switch
6. air pump
7. ozone bulb
8. rigid tubing



Reprinted from "Calquarium" October 1971) \* 74

## WAR ON VELVET

by Joanne Norton

In one of his recent columns, James Langhammer wrote: "One of the biggest aquatic problems in metropolitan Detroit is velvet or Oodinium infections. I believe no one has successfully avoided it although many don't recognize why their fishes have died. Velvet is both a photosynthetic and a parasitic plant. Treatments are nearly as dangerous to the fish as the disease is itself. In acute cases when hours can mean life or death, usually no alternative exists but to treat with copper salts, malachite green or saturated solutions of table salt, and hope the fish can survive the cure. Some can't and many good fish are lost. Aquarists everywhere need to pool resources and experience to find an effective cure for velvet. We need someone with microbiologic and pharmacologic backgrounds. Does anyone have suggestions as to where to start?"

Some years ago when I was keeping khalies only, I experienced both fish losses and frustration due to this parasite. Articles and fish disease books that I have consulted suggest various treatments: copper sulfate, copper sponge, malachite green, methylene blue, acriflavine, potassium permanganate along with salt, and quinine. I have tried all of these except potassium permanganate.

Before discussing cures for velvet, I should mention diagnosis. In advanced stages, the parasite covers the fish's body and fins, looking like a green-brown dusting. At this stage, the fish is not eating well and will soon die if not treated, maybe even if it is treated. To avoid losses from velvet, you must be able to recognize it at an early stage, and to do this you must have proper lighting on the fish. A strong light from above and behind the fish is necessary, and I use a flashlight for this purpose. Lighted this way, the fins, especially the caudal, can be seen to be lightly dusted with tiny spots, much smaller than such spots. This is the time to begin treatment, not suggest that every day you inspect every fish with a flashlight, but when fish show signs of trouble, becoming less active and eating less, then take a close look.

As for eradicating velvet, I shall relate my experiences with various treatments. Although the scope of these tests has been very narrow, it is possible to use the conclusions to better control velvet.

**1. COPPER** - This can be added as a solution (usually copper sulfate), a copper sponge, or a commercial fish remedy containing copper in one form or another. The solutions are added per recommended dosage. The copper sponge is added to the tank, which also should contain snails (biological indicators (snails are more sensitive to copper than are fish)). When the snails all recede into their shells or come to the surface, and even out of the water, then the copper sponge is removed. Before the copper concentration in the water increases and kills all of the fish. By the way, if you have used the copper sponge until it turns dark and does not seem to work, you can remove the dark coating and then reactivate the sponge by soaking it in Sno Bowl, weak hydrochloric acid solution (sold in grocery stores) until it is bright copper color shows. I have used copper via copper sulfate, copper sponge and one brand of commercial remedy. My conclusions, on the fishes I have treated (several species of khalies, guppies) is that copper is too dangerous and is difficult to administer without harming or even killing the fish. I never use copper anymore because safer treatments exist for all of the fish diseases I have encountered so far.

**2. MALACHITE GREEN** - I have had good success treating *Nodohobranchius paucispinus* in a tank with an inside charcoal filter and with peat on the bottom of the tank. Using the brand "Nox-Ich" I added 2 drops per gallon (double the recommended dosage) every day for a month with no apparent injury to the adults or their eggs. However, some khalies could very well be more sensitive to malachite green, so I would use great caution treating each species for the first time. Malachite green is very toxic for some fishes. I would not use malachite green on any fish in limited supply unless I knew the fish could stand the treatment. Therefore, I consider malachite green a very useful cure for velvet, but only for some fishes, not safe for all. I have never used malachite green as a dip, but this might be useful for badly infected fish

that will be lost unless the parasite is removed immediately. William M. Lewis, in his book "Maintaining Fishes for Experimental and Instructional Purposes" states that he has successfully used a malachite green dip at 15 ppm for 2 minutes for control of the encysted form of Oodinium. Of course, after the fish are dipped, they would have to be put into a tank free of Oodinium. Dr. Lewis did not mention which species of fish he had treated this way.

**3. ACRIFLAVINE** - Using the acriflavine dosage recommended by Van Duijn ("Diseases of Fishes"), I killed over 50% of 500 *Aphyosemion* wulkani adults. After some died, I changed all of the water, but many more died during the next few weeks. I will not use acriflavine for velvet in the future.

**4. QUININE SULFATE** - I have on several occasions treated *Nodohobranchius paucispinus* with quinine sulfate, using the contents of a 5-grain capsule (mixed first in a little hot water) for each 3 gallons of aquarium water. The velvet always disappeared in a few days, but after about one week of treatment, the fish always showed this side effect: there was an equilibrium problem, the fish being unable to keep its body oriented as usual. Instead, the fish rises, so the fish resembles a beach stroller. I found that I could save an entire tank of adult khalies having this behavior if I changed all of their water right away. Waiting even until the next morning resulted in large fish losses, a few dying each day for the next week or two. As for those saved by changing the water soon enough, there appeared clean of velvet, but velvet always reappeared on them in 3 or 4 weeks. So I was not satisfied with quinine for treating velvet since the treatment always had to be discontinued so early.

**5. METHYLENE BLUE** - Van Duijn suggests adding 1 cc. (of 1% solution) of methylene blue for each 10 imperial gallons, repeating this dosage in a day or two. He states that the strength can be increased to 4 cc. per Imperial gallon (or 3/5 cc. per U.S. gallon) and that methylene blue in this concentration is non-toxic and safe for tropical fish. I have treated guppies, platies, several species of khalies, and opaline gouramis by adding 2 cc. per U.S. gallon as the initial dosage and then later adding more, up to the last suggested by Van Duijn. Also, as recommended by Van Duijn, I first siphoned the bottom of the tank, at least twice, and removed the filter, replacing it with an airstone. All plants and snails should be removed as the methylene blue kills them. Methylene blue is the only safe and reliable velvet treatment that I have used. The treated water will look as if you added a bottle of ink, and you barely will be able to see the fish. But invisible fish are better than dead ones. The advantage of the methylene blue treatment is that it can be used long enough to eradicate velvet from the fish and tank. A week-long treatment, with quinine on the other hand, apparently eradicates velvet, but leaves enough living Oodinium that it will reappear. I do not know exactly how long the methylene blue treatment has to be for complete effectiveness, but I have had success with 3-week and 4-week treatments at 80 degrees. I would suggest a minimum of 3 weeks.

As to how Oodinium gets into your aquarium, here are several ways that are possible: 1. On newly acquired fish, even though they show no symptoms. A quarantine period of at least a month is necessary. 2. Transfer of the organism from an infected tank to a clean tank by siphon hose, net, transferred fish, water splash, etc. 3. Along with live food collected outdoors. 4. Through the tap. This is a guess, based on the fact that live nematodes have been collected from tap water. Perhaps Oodinium cysts can withstand the chlorine sodium treatment in at least some cases. Since I have seen no velvet-infected fish in my tanks for about ten years I think that Oodinium probably is not present in our tap water, which comes from deep wells. Tap water taken from rivers and lakes would be more likely to carry Oodinium, which may live on hosts or perhaps by means of photosynthesis in its own cells. Oodinium being a dinoflagellate, one type of algae.

Methylene blue kills not only velvet but also skin flukes, gold flukes, ich, and some species of protozoans that cause skin infections. Improvement of infected fish occurs within hours, so methylene blue actually kills many microorganisms rather quickly. In the case of velvet, methylene blue is toxic to Oodinium and therefore eliminates it by this effect, rather than by cutting down on its light supply (which can kill algae by the resulting starvation.)

Methylene blue is effective and likely to be safe on most, maybe all, tropical freshwater fish. I use 3 cc per gallon of 1% methylene blue for angelfish eggs and the fry are in this concentration for about 5 days, from the time they hatch until they start swimming. Since angelfish are very sensitive to many chemical treatments, and since the fry can stand this concentration of methylene blue I would not hesitate at using 2cc to 3cc per gallon on any tropical fish with velvet, especially since the alternatives would be to let the fish die of velvet, or to use a treatment that I know is more dangerous, or to try a treatment that I have never used before. Long enough treatment (3 to 4 weeks) is the key to permanent cure. Using this method, hopefully you will be able to add velvet to your list of "good" diseases (ones you can control without killing the fish). ##

*(condensed from an article appearing in "Tropic Tank Talk", April 1975)*

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### ***Making mistakes isn't stupid... Disregarding them is***

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## **DO BRINE SHRIMP CARRY DISEASE???**

*by Mark & Dan Carson*

Recently we have seen several articles which have suggested that feeding a lot of newly hatched brine shrimp can cause several problems in raising fish. One article mentioned that the baby brine shrimp "carried" the velvet disease Oodinium, into tanks of baby bettas. Another article dealt with the so called white body malady, to which female guppies are especially susceptible. The symptoms reportedly cleared up when the amount of brine shrimp being fed was reduced.

A third article revealed that insecticides such as DDT were found to be present in the salt water where brine shrimp eggs are collected. It reported that Utah eggs show a heavier concentration of DDT than San Francisco eggs and that there "is some evidence" that the level of DDT in the Utah eggs can be harmful. We use the Utah eggs because they are cheaper and our feeding regimen for young fish has been in alternately copious servings of baby brine shrimp with equally copious feedings of microworms. This, coupled with frequent partial water changes gives us the best early growth that we have been able to achieve with fry in the first few weeks of life.

So we are reluctant to discontinue the use of brine shrimp even in the face of these articles and the fact that we have seen some outbreaks of Oodinium on both baby gouramis and tetras and we have had some problems with the white body malady on our female guppies.

Our thinking on the subject was greatly influenced by the experiences of two friends of ours, both of whom are proficient angelfish breeders who raise fish in commercial quantities. Some years ago, one of these men was contending with an epidemic which was wiping out thousands of young angels in his hatchery. After trying all kinds of medications without success, he began to vary some of his customary procedures to see if he could discover the source of the problem. He had been re-using the brine in which he hatched his shrimp eggs and as an experiment began to make up a fresh solution for each hatch. When he did this, his epidemic disappeared. The re-using of the hatching brine is recommended by many on

the grounds that better hatches are obtained in water that has been used several times. There is probably some validity to this claim. Certainly the eggs can be induced to hatch by the introduction of some bacteria which apparently break down the shell of the egg to the advantage of the enclosed fry.

A bacteria buildup in the brine solution could very well set in a similar way on the brine shrimp eggs. However, it is also possible to experiment with the hatching solution and length of time needed for the hatch until a combination is struck which gives close to 100% hatch with a fresh solution. So, the "old water" method is of doubtful benefit.

More recently, our second angelfish breeding friend began losing whole spawns to what appeared to be some kind of intestinal infection. He soon went the route of many medications, to no avail. We told him about the experience of the first friend. This second breeder was not re-using the brine solution but he had made a practice of transferring unhatched eggs from the hatch being harvested to the next hatch. As an experiment he discontinued this and reported a noticeable decrease in the number of losses.

Like most freshwater aquarists we have always thought of salt water as being aseptic. After all, we regularly use salt in the treatment of diseases and we wash tanks with salt water to sterilize them. But in thinking about the two experiences of these angelfish breeders, it occurred to us that perhaps this attitude toward salt water was making us careless about the cleanliness of our brine shrimp hatchery. Since Oodinium is a common disease of many marine fish, obviously some species of this parasite can live in salt water. It would be so foolish that bacteria and viruses can adapt to salt water. It occurred to us that we might be unintentionally carrying some pretty virulent strains of toxins or microorganisms along with the brine shrimp we were hatching.

So, we set up two procedures in connection with our hatching of brine shrimp. The first is simply to mix a fresh salt solution for every single hatch. The second is a complete weekly sterilization of everything used in connection with the hatching of the shrimp. In addition to the hatching containers, this includes siphons and air tubing, syphon hoses, syringes used for feeding, jars and nets. Our procedure is to soak them all in a strong solution of household bleach, neutralized it with Sodium Thiosulfate and rinse thoroughly. This is the same procedure we use to clean filters.

Since we have been following these procedures the outbreaks of Oodinium have been reduced to zero. Our problem with the white body has never been serious and at this writing we cannot document any improvement here. But we would like to offer another line of thought. Feeding newly hatched brine shrimp has been a common practice among guppy breeders for many years. To our knowledge, however, the white body malady has appeared only in the last two or three years. Is it possible that the appearance of this malady coincides with the rising level of DDT concentration in the sea? If there is a relationship here it is the first evidence we have seen of damage to the brine shrimp supply by DDT.

\*\* Editor's Note - The above article originally appeared in Modern Aquarium Magazine - October 1970. Reprinted from Pinner Press - Feb. 1980 - The Carsons at that time still resided at the above address.

## SECOND FAVORITE GUPPY DISEASE

by Randy McDonald, PFGA Active Member

Although no disease should be popular to a fish breeder, pathologists seem to hold a special reverence for them. One of these pathologists, Robert Goldstein, Ph. D., describes parasites, in his book *Diseases of Aquarian Fishes*, as "far more interesting than their hosts." He even goes on to say that "Parasites have a place in this world." So next time your prime show fish starts floating to the top of your aquarium, just smile and think how those poor little parasites finally found themselves a nice comfortable home on your fish.

In ten years of raising guppies, I've only seen two major diseases that occur with enough regularity to be considered "armed and dangerous." The first of these, I've described in the November 1975 GUPPY ROUNDTABLE and is called simply, "The Guppy Disease." I'm sure most of you will be familiar with the second disease I am about to describe.

It begins with a general nervousness of the fish. They group toward the rear of the tank and show a very frightened behavior at any movement you make. Their bodies tend to vibrate very fast and their breathing is also faster than normal. Males tend to look humped as their tail points downward while the head remains normal. These described symptoms are your first clue that something is wrong, and treatment should begin immediately. The secondary symptoms occur in a week or two and lead to the destruction of the fish. The males show a swollen abdominal region as if you over fed them with live baby brine shrimp. A horizontal line of opacity (milky white area), sometimes will develop between the abdominal area and the tail when the upper musculature of the peduncle region. This is always followed by death within three days. The females show very little of the secondary symptoms but simply die one at a time when the males have reached the final stage.

This disease, which I will term general bacterial septicemia was studied for me by Neil Willis, pathologist for the Mojave River Fish Hatchery in Victorville. According to him, the bacteria fill the abdominal cavity without infecting any of the vital organs. Then, if the fish lives beyond this point, the disease progresses into the musculature. Among the infected muscles the white opaque appearance. Toxins excreted by the bacteria account for the mortality of the fish.

Through trial and error I've come up with two medicines which cure the disease. The first, methimazole is available in a product called Microstat, manufactured by Aquatic Marine Biochemicals and Drugs, and is a 0.05% solution which is added to the aquarium at a dosage of 4 drops per gallon with thorough mixing. The second medicine is called Furazone Oream, prepared by Dyna-Pet and is a mixture of monofurazone, furazolidone and methylene blue. The contents of each capsule treats ten gallons of water and dosage should be repeated in twenty-four hours.

Treatment should be continued for two weeks, changing the water twice a week and adding a full dosage of medicine at each water change. Fish that still remain bleated after this period are not contagious but are best discarded since they have been damaged beyond repair.

Aquarium City in Canoga Park has tried my method on not only guppies, but on other fish, such as Gouramis which had been extremely bleated, and have had overwhelming success with complete cures. As my suggestion, they have taken all their livebearers off of fish food and put them on Aquatrol squid flakes. According to manager Mike Lascorain, body fungus (Guppy Disease) has been reduced 90%. The other 10% could have been caused by residual spores still in the tanks.

My contention is that these two diseases are brought in by spores in foods fed to the fish. Although the prime ingredient responsible has not been located, I will continue to search for it in the future. As Robert Goldstein said, "The parasite world is generally unknown to aquarists, but it is an exciting world nevertheless." Anybody care to get in on the excitement?

## SECRETS YOUR GUPPYS DON'T TELL YOU

by Midge Hill

### PART III

#### THE SENSES

Guppies have all five senses: sight, hearing, smell, taste, touch, and one more "sixth" sense which is unique to fish. The main organ of perception is the brain, which is the enlarged terminal of the main nerve cord which runs through the vertebral column along the upper part of the body. Impulses from the sense cells are carried to this central station.

#### How A Guppy Sees...

Sight in guppies functions much as it does in humans, except that the problem of water refraction must be coped with if the fish tries to look at anything above the surface of the water. The light rays bend as they pass through the water surface so that when feeding on an insect above the surface, a fish must aim well ahead of the target it sees. As the guppy usually feeds in the water, it does not have much problem with light refraction as light travels in a straight line under water just as it does in the air. A more important factor to the guppy is the blurring vision caused by the fact that even the clearest of water is much less clear than air and closed-system aquariums are not always even the clearest of water.

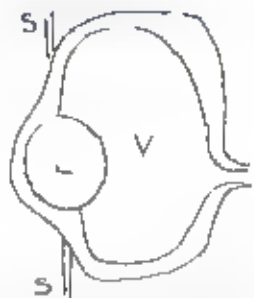
Since the light is usually not bright under water, the eye structure of most fish has been simplified so that they get along with little or no contraction of the iris. The iris, the metalike-looking ring around the dark pupil, does not widen or shrink to regulate the amount of light

passing into the eye, the task is very rudely inflexible. No wonder the guppy will seek a dark corner when a bright light or flood light is shone in his direction, his eyes cannot make enough adjustment to cope with it.

Being constantly bothered with the lack of use for either eyelids or free of forebrain matter. The eye pigmented layer of skin, which all adds up to the fact that the surrounding water. The eye of the guppy tends to wash the eye and keep it more or less covered by a transparent, unfreezing passes the light through. Which guppy has no way to close its eyes.

Since guppies mostly need to see objects at only fairly close range, their eyes are built with lenses that are more spherical and rigid than our eyes. His eye is set to see objects in the immediate foreground, but if it should need to look further, the entire lens can be pulled backward in the eye by a special muscle. But even at best, the guppy probably can never focus well. To prevent the problems of light refraction as light rays enter the watery substance inside the lens from the surrounding water, the lens must be sharply curved to focus an image on the retina. The sharpest curve attainable is the sphere, hence the spherical lenses of the fish eye. Even this may not be enough to give it a really well focused picture (see figure 1 on next page).

However, guppies do have an advantage over us with their monocular vision. They can see in more than one direction at a time and thus see more of the world around them at one glance than we can. With an eye on each side of its head, a guppy can focus on both sides of the field of vision at the same time. This makes it difficult to judge distances, but probably there is a relatively narrow area straight ahead which allows both eyes to see simultaneously, giving the fish a limited measure of binocular vision, and hence some sense of perspective. When a guppy whirls around in response to something that attracts its attention on one side, he is probably bringing the object into the narrow common field of vision of both eyes where its distance can be better estimated.



**Figure 1. Schematic fish eye.**  
S= skin of head, V= vitreous body, L=lens  
by Alex Bartsch as printed in "Anchor",  
SPAS)



**Figure 2. Monocular Vision** Eyes focus on  
both sides of the field of vision at the same time.  
Shows the limited area of binocular vision where  
the two fields overlap

### Can a Guppy See Color?

Guppies show evidence of seeing color. The nerve cells in their eyes are supplied with visual cones (the cell is just different in between colors) and visual rods (which are mainly used at night). To what extent guppies make use of color in their daily existence is however still a mystery. Some show preference for one color over another and many have been trained in experiments to respond to specific colors in specified behavioural patterns. If a spectrum is shined into a darkened aquarium, fish will normally go for the green and yellow bands and remain in them. If on the other hand a red light is used, they behave as if they were in the dark. Guppies come in such brilliant contrasting colors and patterns that it would seem the color must have some significance. However, as a general rule, guppies are not color selective they do not seem to identify with other similarly colored guppies, nor do they shy away from those wearing a different color. (As any breeder knows when a blue male gets into a tank of his prime show stock)

It is probably that, like goldfish, guppies have trichromatic vision meaning they can distinguish a wide variety of colors regardless of variations of their brightness. Experiments also indicate that fish cannot be fooled in differentiating colors by a decrease in light intensity. In fact, in this respect, their color discrimination far exceeds that of humans. The ability to discriminate color even in very dim light is no doubt a result of necessity as many underwater habitats vary in light and depth. Moreover, if a fish has been trained to go to a specific color they will continue to choose that exact shade over any other shade or depth of the same color, nor even over the same color created by shining a colored light on a gray surface (this fools people every time). In fish the most confusion has resulted in distinguishing differences between reds and yellows.

### How the Guppy Hears

Much study has been devoted to whether guppies hear in our sense of the word. Probably they cannot. Their ear, which is composed of two closed cavities on opposite sides of the head, seems to be purely a balancing organ. However, using underwater microphones and tapping devices, it has been found that fish

do make noises under water...sound waves have been recorded for apparently intentional sounds made for some specific purpose. Short bursts of sound have been recorded in response to territorial threat, as breeding signals and as recognition signals. It therefore seems logical to suggest that such sounds must be perceived by fish in some way...the likeliest explanation seems to be that, using the swim bladder as a resonator, they can sense sound waves.

### Does a Guppy Feel Pain?

There seems to be no very satisfactory way to learn from a fish just what it feels in the way of physical pain. Pain is an experience of the brain responding to information conveyed to it by the various nerves. But guppies have no brain structure similar to the cortex, which in humans produces pain, and there is no other part of the brain which appears to perform this function. Their most common reaction to excessive stimulation is merely to seek escape. The lower we go on the evolutionary scale, (and fish are comparatively pretty low), the higher the pain threshold (the amount of sensory stimulation required to produce pain) becomes. For this reason, there is considerable doubt that a fish can feel much in the way of actual physical pain. (At least, that is what the scientists think. I wonder if our guppies will agree?)

### Learning Ability

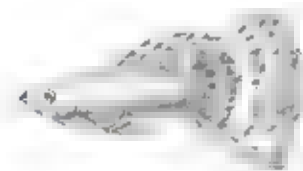
The guppy, like many other fish, has an extremely rapid learning ability and quite a reliable memory. Although it is not easy for a fish to learn something that runs contrary to its instinct, fish can very easily learn something that produces a 'reward' desirable to the fish.

Goldfish have learned to treat themselves to a cool squirt of water whenever they felt uncomfortably warm, by pressing a lever. A stickleback learned to swim through a small ring for the opportunity to ingest and court a pump female. Many kinds of fish, including guppies, have learned a wide variety of 'tricks' for edible rewards, even to threading intricate mazes. Even more remarkable is that the fish remember what they have learned and within a few days can perform with very few errors.

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Reprinted from THE GUPPY ROUNDTABLE May/June 1971



## SECRETS YOUR GUPPY'S DON'T TELL YOU

### PART IV

by Midge Hob

#### The Sense of Touch

The sense of touch is conveyed to guppies by small, sensitive nerve organs scattered over the skin, particularly abundant around the head. Since water is an excellent conductor of sound waves and pressures, the sense of touch is closely connected to and plays an important role in the life of a fish.

The highly developed sense of touch works in three basic ways, the general sensation of touch, the orientation to the flow of water, and the perception of the direction of flow.

The fish is responsive to localized pressures located in or under the skin. Though scattered all over the surface of the body, they are concentrated in pressure areas usually around the head, lips and mouth region. When any pressure is felt by the tactile cells, the resulting impulse is carried to the spinal cord and brain by the nerves.

The tactile sense which orients the guppy to the flow of water is located in the side pocket area about the skin. The current bends there, allowing the fish to orient itself correctly with the current by feel. It is this sense that causes the guppy to head into the flow of water set up by an airstone or filter. This is primarily related to the quest for food, since the natural enemy runner is food is likely to be carried along by the current.

#### The Lateral Line

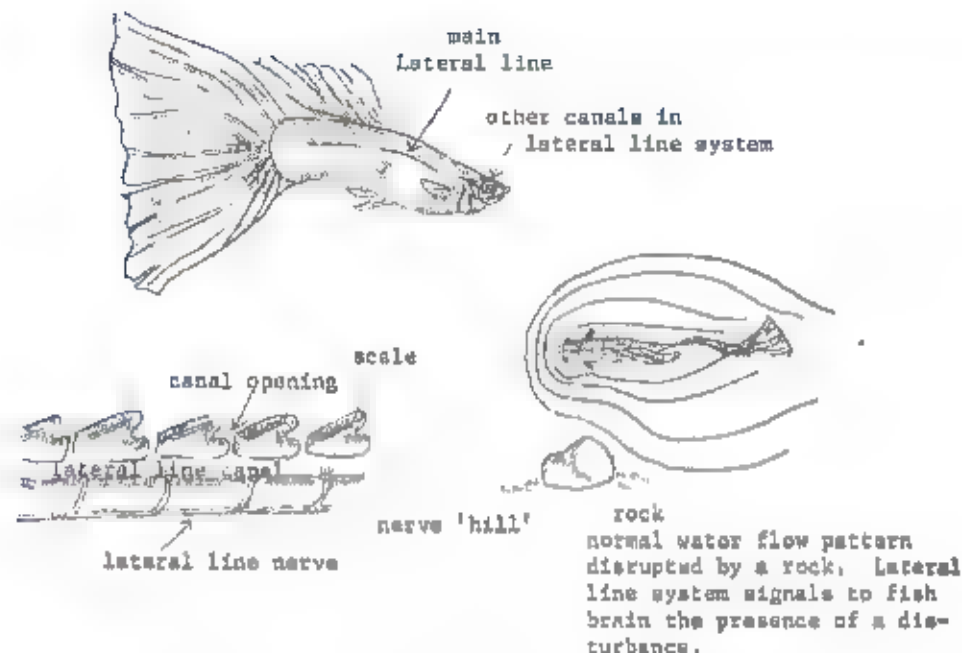
Ever wonder why guppies which dart hither and thither rapidly, never bump into each other or other objects? The tactile sense which is so delicately attuned to movements and currents in the water, is the most extraordinary of the fish senses. Laterally a sixth sense unique to the fishes, fish like vertebrates, and certain amphibians. Basically it is a sensory organ which detects water movement around the body, monitoring the flow of water so the fish can react to disturbances or changes.

The lateral line, located along the side of the fish, is sensitive to low frequency vibrations and pressure waves built up as the fish approaches rocks, barriers, aquarium walls, other fish and even brine shrimp. The lateral line is quite visible on the guppy (see illustration). It is in reality a series of openings, behind which are found, imbedded in the skin, highly specialized sense organs. Other similar canals also equipped with sense organs, branch all over the head and face. (See illustration).

When a guppy swims through the water it sets up a flow pattern around its body and this characteristic water movement registers on the lateral line. When any nearby object disturbs this normal pattern, signals travel from the lateral line system to the brain by special nerves and alert the fish to the presence of a disturbance.

The lateral line is more or less an enclosed canal just below the skin which is filled with mucus which moves back and forth in response to external water movements.

It is entirely possible that the quivering motions made by the excited male guppy, produces a characteristic water movement that triggers a hormonal response from the body he is courting, and therefore is also important to breeding. The system also aids in feeding as the guppy can accurately locate a passing brine shrimp or mosquito larva even in the dark.



(illustrations 2 and 3 adapted from "African Aquarist, 12-68)

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Son: "Dad, what is the most you ever paid for a guppy?"

Dad: "Better go ask your mother. I forget who I sold her."

## GROWTH-INHIBITING SECRETIONS - GIS

by Kuppv Sprenger

There are a number of factors to be considered when one tries to understand how and why the growth of fish is not what one expected it would be. Briefly, the major ones are food, temperature, filtration, lighting, water conditions, temperament of the fish and general healthiness in the aquarium. Each and all of these merit an article, but many have been discussed previously. The GIS problem is not so well understood.

First, two examples of the results of the growth-inhibiting secretions, and in both examples we are assuming that only space and "goodness" of the water are less than optimum; that all other factors mentioned above are as they should be. Let's start with a livebearer, the guppy, and the surprising cessation of reproduction. All fish look healthy and seem to be normal, nothing appears to be "wrong" anywhere, except that when guppies stop reproducing—or almost stop—something is odd somewhere. A second example will be with a prolific egg-layer like the Angelfish. Several hundred fry hatch in a relatively large aquarium and begin eating and growing. After a couple of weeks some are larger than others; as time passes, the smallest fry show almost no growth at all and eventually they begin dying. If all the tiny ones (or all the large ones) are placed in another aquarium, the smaller will resume growth. But within a few weeks different rates of growth will appear again—even to the extent that the largest of the smaller ones is near as large as the largest of the originally larger ones, and the smallest from both groups are also very similar in size. We usually call these tiny remnants the smallest "runts." What caused the livebearing guppies to stop reproducing and the egg-layer fry to show such varied growth patterns? Growth-inhibiting secretions produced by the fish themselves might well be the answer.

Why? Probably the most difficult thing to swallow about this theory is the "Why?" Where does it fit in, in nature?

My hypotheses is as follows: Under normal conditions, these secretions would have no effect in nature. There would be enough water, food, oxygen, etc. for all. Predators, disease, and general weakness would take their usual balancing toll. And the "removers" of the inhibiting secretions would probably help also (which will be discussed later). However, prolonged drought, pollution, or other factors might at some times occur, threatening the lives of all the water creatures. Some fish would then take to land in flood a better place to live, as did the *Clarias* catfish. Others, like the African lungfish, might eventually curl up in the mud to estivate until fresh water and its promise of the future returned.

The killifish, which often live in places that dry up on a seasonal basis anyway, would follow the usual pattern of laying eggs that will withstand drought and hatch when the water finally returns. But what about the other fish—most of the freshwater fish of the world? They can do none of these things. They cannot escape by migration or estivation, nor will their eggs or fry withstand the lack of good water.

Now then, most fish spawn on a seasonal basis at certain times of the year one is more apt to find growing fish in great numbers than at other times. So, assuming that there are thousands of fry of approximately the same age and the same size living in a particular body of water, all with just about the same requirements and weaknesses, what would happen if the rainy or wet season produced the most glare after a long, hot summer in which the water level dropped considerably? All those fry would be heading for trouble, wouldn't they? And chances are they would all begin dying at the same time, because none would really have an "edge" on the others. If a few lived longer, they would, logically, be in serious conditions, nearly dead.

Okay? But if something occurred to cut down the population of growing youngsters long before the food and oxygen were really putting them in stress situations, before CO<sub>2</sub> and other gases had built up to a nearly lethal level, mightn't a few heartier fry have a better chance of surviving than would the many? This "something" that would occur might be the effects of growth-inhibiting secretions. If there is a limited amount of food and oxygen, a few will survive longer than would many, and their poisoning excretions would be less. So, as soon as the concentration of these secretions begins to build up, "stunting" and then death removes the smaller fry. Because the growth-inhibiting secretions are pretty potent substances, the population would be cut down long before the usual physiological dissimilarities did their job of "culling." If only the minor physiological differences determined who died first, the conditions would probably be critical before any noticeable decrease in the population occurred—which would be under conditions where food and decaying bodies would hasten the pollution of already "bad" water. Should the situation be relieved soon enough, by rain or snow or something else, the growth of those remaining would resume. This then is a possible "why" or the findings of Drs. Rose, Rose, and Allen that follow.

In their tests, tadpoles were used most frequently. The main reason being that tadpoles have no social status among themselves, they do not bully or bother each other. They also are capable of rapid growth. However, work with the following animals has resulted in findings similar to those of tadpole study, snails, snout, trout, and buccaria. It has also been found that tadpole eggs can be effected by the secretions from growing tadpoles of their own kind. It is known that plants have a similar effect on their own species, and in certain animal-animal contact can produce stunting. In all their studies, unless otherwise noted the test animals were given more food than they could eat.

There, briefly, and non-completely, are the results: Growing fry (or tadpoles) produce substances in the posterior part of the gut that affect the growth of their own species. This inhibiting secretion is a product of growth itself; water taken from a larger tadpole's container added to the container of a smaller tadpole will inhibit the growth of the smaller one; however if food is withheld from the larger tadpole, and as water is being given to a smaller one, growth of the smaller one will not be affected. If certain types of algae are present (in which the tadpoles feed), the effects of the secretions are prolonged. The stunted animals are in a state of "suspended Growth" and if given fresh water will resume normal growth unless they have begun losing weight. If weight loss has occurred, they will probably die anyway. The smaller are more susceptible to the secretions than the larger, although one growing tadpole alone in a container will inhibit its own growth to some degree. It is felt that size, rate of growth, and rate of feces production—the substance is released into the water with/from the feces—are important factors in determining inhibitory potency. In tests of different numbers of tadpoles kept in containers of the same size, there was greater total weight per container at the end of the test where more tadpoles were kept, but the individual weights were higher in containers where fewer were kept. In other words, the more there were, the slower they grew. That, then, is the general idea.

Why do the larger animals affect the smaller, but not vice-versa? One possible reason is this. Since the secretions are a product of growth, the individual secreting them is obviously tolerant to the amount of secretion he releases. A faster growing animal secretes more than a slow growing one; therefore a larger faster-growing animal in the same amount of water will have little difficulty with a smaller amount of inhibitor released by the slower animal. But the smaller and slower animal, tolerant to its own amount (concentration in the water), would find a rather rough going when soaked with double or triple the amount of inhibitor secreted by the larger animal. It would probably also be noted that one much larger tadpole would have the same effect on one tiny tadpole in the same amount of water as a number of slightly larger

tadpoles would. Many medicines are prescribed on a weight basis; the medicine itself is the same, but the amount that will not harm an adult is much more than the amount that will not harm a baby.

Thus far, this might sound like a losing proposition for the fish breeder. But not necessarily. Among their findings are these items. When fish or other animals of different genera are kept together, both genera do better. Job bring substances of the one may be removed from the water by the other. In fact, growth might be increased in these conditions. Tadpoles placed in absolutely fresh water showed no growth whatsoever for three days. The time it took for them to adjust the water to themselves (which is more accurate than stating that they adjust to the water). It is felt that to condition new water fish of another genus, where growth has stopped or is not being encouraged, should be used.

Snails seem to remove the inhibitory effects in the tadpole stages. Another means of partially preventing a build up of inhibiting secretions, is that of removing portions of the water and replacing it with fresh water on a frequent basis. How frequent depends upon the amount of water per fish and the normal rate of growth of the fish. In the example of the crowed guppy tank where reproduction had stopped, the addition of more guppies would only make matters worse. However, the addition of white clouds into these already overcrowded conditions caused a resumption of reproduction. So, there are ways to get around the LFS, but don't forget that short cuts in care have never yet brought home a winner and for the best fish, more, rather than less, care and thought are the answers.

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## THE SENSES AND SENSE ORGANS

by M. Seaga

**SIGHT:** The eyes of fish are hollow and have a muscular control with a normal range which permits them to move up and down or sideways within the orbit. Long sight would be of no advantage to a creature living even in clear water, which considerably restricts the range of vision. Scientists are not entirely agreed as to whether fish see color or not, but the eye is known to be associated with color changes in the appearance of the fish, which commonly adjust to camouflage with changes of surroundings. Blind fish lose this capacity, and become even y darker colored, except blind cave fish.

Shallow fish which are non-predatory, bear eyes set into the side of the head, giving a very nice radius of simple monocular vision both sides of the body, with only a very narrow radius "blind" in the region of the midline. Binocular vision is of little importance to these fish and is only possible over a very small radius in front of the head. A blind visual alertness to attack is their primary need. Predatory fishes on the other hand, have eyes set forward and on the upper surface of the hood to give them a good overall view of the surface above them and a wide radius of binocular vision which is essential for judging distances, so that they may accurately grasp their fleeing prey. The radius of monocular vision of either side is correspondingly limited.

Vision is modified by refraction. Anyone studying fish below the surface knows that his line of sight must be close to the vertical to prevent dazzle obscuring the view. From the fishes point of view, much the same is true since there comes a point at which total reflection occurs because the line of sight of the fish

reaching the surface at an angle 50 degrees or more is bent horizontally along the surface itself.

This means that a fish at any given point can see through the surface only so long as the line of sight strikes the water at an angle smaller than 50 degrees to the vertical. The fish therefore views the outside world through the circular "window" the size of which is determined by its own depth in the water. The nearsightedness of fish prevents effective vision beyond ten or twelve feet.

1. Tests have been carried out on certain predatory fish. Food dyed red, blue, etc., to which pepper, mustard, etc. have been added. Over a period, fish become wary of any colored food, associating it with disagreeable taste, even on colored food not containing added flavor — Professor Reighun Tortugas — Marine Biologist Station, 936.

2. Catfish and other fish which mainly feed at night have a range of vision approximately 3-4 feet.

**HEARING:** Fishes do not possess external ears, which would interfere with streamlining. They do not require them in any case, since the internal ear structure is in direct contact with the water through the skin and is therefore capable of transmitting vibrations and sounds to the central nervous system. The ear is also equipped with semi-circular canals which are responsible for balance and kinetic sense.

This is also aided by the functioning of the lateral line which picks up information about pressure variation necessary for station keeping and body control in swift surging and variable currents of water. The lateral line is capable of detecting vibrations of certain frequencies which are transmitted to the brain. The swim bladder too is associated with hearing in some fishes, being taut like a drum and capable of low frequencies. In some fishes this is linked to the ear by means of a series of tiny articulated bones called the Weberian ossicles. After F. H. Weber De Aarte et Auditu Homines et animalium 820.

**TASTE AND SMELL:** Taste and smell are a most indispensable aquatic creatures, which receive impulses of this kind through the agency of the concentration of substances in solution. The mouth and barbels, (not all fish have barbels), bear "taste cells" and the nostrils, each of which consists of a pair of openings, are also equipped with sensory cells. Water is constantly flowing into the first opening, through the connecting canal and out of the other. In doing so, it passes over the sensory cells which obtain information from it, detecting food flavors and such things as chemicals or water pollution.

Barbelled fish are usually bottom feeders. The barbels serve as an additional set of sense organs in helping them to locate concentrations of micro organisms in the sand or gravel of the aquarium and worms, etc. in the wild. Often the water in the fishes natural habitat is dark or muddy and prevents them searching for food by purely visual means.

3. Fish having elongated ventral fins, e.g. gouramis and angels, etc., bear taste cells at the tips of the same.

**THE GILLS:** These are provided with fine feather-like tissues richly endowed with tiny blood vessels. There are four gill arches on either side and a large number of gill filaments, each covered by a very thin, highly vascular mucous membrane on each arch. They have a wide surface area over which water flows so that oxygen can be extracted from the water to be taken up by the blood and for carbon dioxide in the blood to be given up to the water. For protection from gritty particles which might damage these delicate tissues the gills are supplied with rakers or comb-like appendages which filter off solids in suspension and also serve to collect or strain tiny food particles, which are directed to the gullet.

4. Five gill arches support on y four gills. The first arch is known as the hyoid arch.

**THE DIGESTIVE SYSTEM** Non-predatory fishes feed largely on small particles which require little chewing and absorption by the system. Vegetable matter forms a large part of their diet. Chewing is performed by the pharyngeal teeth which are attached to the fifth gill arch and set behind the gills so as not to interfere with the ordinary business of respiration.

These teeth are often the only certain means of identifying such oddities as possible hybrids. Non-predatory fishes have no separate stomach; the gullet merging occurs throughout the length of this tract where digestive juices and enzymes break down and extract from the food the substances containing cellulose by the action of bacteria in the lower intestine.

In predatory fishes (there are exceptions), the teeth in the mouth are used not to "chew" but simply to grasp prey. Once swallowed, this is received by a pouch-like stomach where powerful digestive juices are set upon it. The rhythmic movements of the stomach assist in breaking it down into a sudge-like consistency capable of being dealt with by the intestines, where it is finally absorbed by enzymes and juices from the pancreas. Undigested food and waste products from the kidneys are passed to the vent where they are expelled.

**HYBRIDISM:** Uncommon in the sea, but fairly common in fresh water, occurs when two stocks of different but closely allied species happen to be spawning simultaneously in close proximity to each other. Fishes on the fringes of both stocks may become mingled accidentally and eggs from one species are fertilized by sperm from the other. The resulting hybrids are termed *ale* between the species and, in most cases, are found to be infertile. However in laboratory experiments it has been proven that one or two species can produce fertile hybrids. It is quite impossible to cross a livebearer with an egg-layer.

**SWIM BLADDER:** The air bladder is a membranous sac lying below the vertebral column in the center of gravity. It is divided into two lobes; the rear lobe is a trifle larger. The air bladder contains oxygen, nitrogen and a trace of carbon dioxide. In the lung lobe, the proportion of oxygen is higher than in atmospheric air, due to excretion and absorption of gasses through the walls of the bladder. Besides serving as a reservoir for oxygen, the air bladder serves at least for two other purposes. In the first place, by the adjustment of its contents, the fish is able to alter its total specific gravity, in order that it may float without effort. At the same time considerably reducing its energy requirements when swimming. Misfunction of this organ occasionally occurs for some unknown reason and causes abnormal postures and positioning of the fish.

**LABYRINTH ORGAN:** Fish belonging to the family Anabantidae (gouramis, etc.) are equipped with an auxiliary breathing apparatus known as the labyrinth organ. This organ is situated in the head. It enables the fish to gulp surface air and to store it in this compartment. Oxygen is extracted and passed to the blood stream. This imprisoned air lasts for a considerable period when the fish is inactive, but if the fish becomes nervous or excited or its metabolism is speeded up by increased heat, the store of air in the labyrinth is used at a faster rate.

When this occurs, the fish frequently returns to the surface for fresh supplies. On gulping more air through the mouth and forcing out through the gill covers. This family is able to live in drier, cooler and warmer water than can many others. It is a mistake to think they do not extract dissolved oxygen from the water in which they live. On the contrary, they use up nearly as much of this gas as do other fish.

Reprinted from Edgewood Valley Aquarium Society via many other exchanges

A microbiologist thinks that man evolved out of organisms found in hot water... so here we are, right back where we started.

## EXPANDING OUR KNOWLEDGE OF THE FISH WE SPECIALIZE IN...

### LOOKING WIDER

#### ARTIFICIAL INSEMINATION IN GUPPIES

by Bob Fisher

A few months ago I was browsing through a magazine on dog breeding and happened to come across an article on artificial insemination as applied to dogs and cattle. What interested me most was the fact that semen could be stored after processing for very long periods of time—as long as 12 years. So that an extremely good bull could still be producing calves long after he himself had ended his days as red brand steak on someone's dinner plate.

The technique of artificial insemination is simply that one secures a suitable sample of sperm from a selected bull and introduces this by syringe into the genital tract of a selected heifer. Thereafter nature takes its course and in due time a calf is born. Of course, this immediately set the wheels in motion and I began speculating on the possibility of this technique for guppies.

I think perhaps the most exasperating experience one can have with fish is to get a prime pair but simply will not produce. If a male is too fat or heavy or just plain old or out of condition, or if he is just plain lazy, no offspring will come along. Then too, some virgin females, when left too long, about six months or more without being bred, are most un-cooperative, resulting in no offspring. I decided to try my hand at the thing nature along with me. It wasn't easy but it was successful and a profitable experience.

For my first experiment, I selected an outstanding male which had never bred any female. He was top show stock but one sick in the breeding tank. Since he had developed a rugged tail, I was not afraid that there was any great loss involved. I had a few females which were 7 months old and had never been pregnant, so I picked the best of the bunch, a plump well-rounded female full of eggs but quite pink in the anal area.

It had been my good fortune a few months earlier, while dissecting a male, to discover where the spermatophores were ripening—just above the anal opening in the roof of the body cavity. Using a high-powered glass, I cut my male open and mounted the spermatophores. I took a hypodermic needle and filed the tip until it was rounded and dulled (the thinnest needle I could get). Then, using the syringe, I sucked up some of the contents of the spermary at the ripe end into the needle and was ready for the female.

Holding her in a wet net held by up, I worked the tip of the needle carefully into the genital opening, being careful not to puncture anything. One squirt and the job was done.

I could hardly expect to be successful the first time around but might be my surprise and delight when three weeks later my female was swollen up like a balloon and ready to pop. It cost me a "useless" male, but now I have a tank of young I couldn't have had any other way. I could have waited several more months before reporting this, but I feel that this is important enough to be made known so others may benefit. I am presently carrying on efforts to extract the sperm sample from a male without the necessity of dissection. If this can be done, then this will provide breeders with a sure way of selective breeding which can definitely benefit the future genetic development of the modern fancy guppy.

As it now stands, the technique can work, but requires the death of the male. But in my own view, if a male cannot produce young, he might as well be dead. There is nothing quite as useless as an impotent male past show prime. If this technique can be applied and the male made useful by artificial insemination, then he has served a good cause.

Of course, any young produced this way are perfectly normal in every respect and will be able to themselves produce young when mature. The female in question is still alive and kicking and soon to be the bearer of a second batch from the first artificial insemination treatment. It will be interesting to know how many batches she will mother before the supply of viable semen runs out.

One word of caution to those who want to try artificial insemination for themselves. First, the spermatozoa are very delicate and need utmost care in manipulation. Also, the genital tract of the female is very small and quite hard to find. Don't just go stabbing - you can hurt her badly. Just the gentlest treatment and you will find the opening readily. I haven't tried the technique on a narcotized female yet, but believe it would work well.

(This article originally appeared in "Rugged 'Iwas", December 1966. Roy Shoemaker in "Tropical Breeze, July 1964 describes a method that does not necessitate killing the male see below.

**Anesthetic:** Mix 1 part quinine to 9 parts acetone. Add 1/4cc of this stock solution to an even gallon of water.

**Equipment:** Hypodermic syringe with a 'rounded' #20 or #22 needle, low power microscope or pair of binocular magnifying glasses of 5 power or more, the container holding the gallon of anesthetic solution, a second container holding one gallon of water at normal tank temperatures, a net and a damp cloth.

**Method:** Net both fish you plan to use and drop them into the container of FRESH WATER. Dampen the cloth and put it on the table in front of you. When it is prepared, take the male in the net and dip him in the anesthetic. In less than one minute he should be asleep. When he stops swimming, take him out and put him on the damp cloth. Turn him on his back and stroke the sides of the fish with finger and thumb from behind the gills toward the vent. Do this 4 or 5 times. Then with pair of tweezers or your fingers, swing the gonopodium in a half circle from head to tail. This squeezes out the sperm, which can be seen at the vent. Pick this up with the syringe. Then put the male back into the holding container. Anesthetize the female and she stops struggling. Then turn her on her back on the damp cloth. Gently insert the needle into her vent and squeeze the sperm from the needle. ###

## WHAT SCIENCE HAS LEARNED ABOUT THE GUPPY.

### A brief review of some aspects

BY DR. T. J. LAM, B.Sc. (H.E.S.), PH.D. (B.R. COL.)

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The guppy, *Poecilia reticulata*, has long been a favorite experimental animal with fish scientists. This is because the guppy is a relatively hardy fish, easily maintained and bred, and readily available even in temperate countries. An added attraction is that it is a live-bearer whose sexes are easily distinguishable. And, of course, the fact that it is an economically important aquarium fish has increased its appeal to the scientist.

Thus over the years, scientists have learned much about the guppy. Much of this information, however, concerns academic aspects which would be outside the scope and interest of this short article. Only those

aspects which would be of interest to the guppy hobbyist or breeder will be dealt with here. The treatment of the facts will, of necessity, be brief and somewhat simplified. However, wherever possible, references will be included from where the interested reader can obtain further information.

For convenience, the information will be considered under several headings:

(a) reproduction, (b) sex differentiation, (c) growth, (d) behavior and (e) seawater acclimation.

### (A) REPRODUCTION

Although the guppy is a live-bearer, the mode of reproduction is not similar to that of man or other mammals. In the guppy, the egg is fertilized while it is still within the follicle ('egg case') inside the ovary, in mammals the egg is released from the follicle (ovulation) prior to fertilization. The guppy young therefore develops within the egg follicle inside the ovary, where it does not receive any nourishment directly from the mother besides what is available inside the follicle itself. In mammals (with a few exceptions), the young develops outside the ovary in the uterus (or womb) where it receives a continuous direct supply of nourishment and oxygen from the mother via the umbilical cord which is attached to a special structure of the mother called placenta. Thus the guppy is not a truly viviparous (live-bearing) form in the original sense of the word. Scientists have therefore described the mode of reproduction in the guppy by a different, but related term, viz. 'ovoviviparity'.

Another fact is that the guppy, unlike most animals, produces sperm balls called spermatophores. The individual sperm are packaged into balls before being discharged, by way of the 'copulatory' organ, the gonopodium, into the female. A single copulation may give several broods of young because the female guppy has the ability to store sperm inside the ovary. As a new batch of eggs matures, they are fertilized by the sperm stored in the ovary. The stored sperm, however, may be replaced by sperm from subsequent copulations.

As in other vertebrates, reproduction in the guppy is under the control of the pituitary gland, a small gland situated just below the brain. More specifically, it is under the control of the gonadotrophic hormone(s) called gonadotropin(s) secreted by the pituitary (see also Lam, 1970). Removal of the pituitary (hypophysectomy) causes the gonad to regress in the adult guppy and prevents gonadal development in the young (Pardey, 1969a,b). If the gonadotropin (from a mammalian or fish source) is then injected into these hypophysectomized guppies, gonadal development will be restored (Pardey and Ormiston, 1969).

Thus it is possible to induce rapid gonadal development and maturation in the guppy by injections of gonadotropins. However, more than one injection may be necessary and the guppy may not be able to tolerate repeated injections.

A more practical method to accelerate gonadal development and maturation in the guppy is to make use of environmental factors which would stimulate gonadotropin secretion by the fish's own pituitary. Light has been found to be one such factor. By exposing guppies to continuous (24 hour) light, Scrimshaw (1944) was able to shorten the hatching interval of the fish from about 10 to 2 days and thereby induce superfecundation, a condition in which several broods of young are developing simultaneously within the ovary with births occurring at short intervals of time. Presumably gonadotropin secretion had been stimulated in the fish by the continuous light. The hormone, in turn, shortened the period required for the development and maturation of the eggs so that a second group of eggs reached maturity and was fertilized before the previous group completed development.

We have extended Scrimshaw's work and found that both the duration and intensity of light are important. Long photoperiods (>100 foot-candles) at the normal photoperiod (about 12 hours) could induce greater development of the gonads in the guppy when compared to the controls. However, it is important to

note that under these conditions, the fish should be fed adequately, otherwise the enhanced gonad development will occur at the expense of body growth.

Under normal conditions of light, the number of eggs or offspring produced by the female guppy appears to be affected by the diet. Hester (1963) found that guppies produced fewer offspring when they were kept on short rations.

From the above findings, it would appear that the best way to get guppies to breed rapidly is to give them an adequate amount of good food as well as long hours of light coupled with a high light intensity.

## (B) SEX DIFFERENTIATION

A male guppy looks so differently from the female as a result of the production of two different sex hormones by the two sexes. The male produces the male sex hormones, generally called androgen, from the testes while the female produces the female sex hormone, generally called estrogen, from the ovary. The androgen consists of several chemically related compounds; an example of which is testosterone. Similarly, the estrogen consists of several chemically related compounds; an example of which is estradiol.

Female guppies may be induced to assume external (secondary) male characteristics by treatment with androgen (e.g. testosterone) and vice versa by treatment with estrogen (see review by Pickford and Atz, 1957; Yamamoto, 1964). The gonad itself may or may not be affected by the treatment depending on when the treatment is given and how much is given. If testosterone is given to young females at an adequate dose, the ovary may be converted partially into the testis giving rise to an ovotestis, vice versa with young males treated with estrogen. Complete sex reversal is not possible at this stage whatever the dosage of the hormones used. In fact, complete sex reversal is only possible if the fish is treated at the embryo stage when they are still inside the mother's ovary, i.e. by treatment of pregnant females (Owino, 1962).

If, however, adult females are used, testosterone may just cause the development of external male characteristics in the female without affecting the ovary, i.e. if, unless, perhaps, a relatively high dosage of testosterone is used. It is therefore theoretically possible to use testosterone to determine the color pattern of an adult female before using the fish to cross with a male of selected color pattern.

It is noted that the hormones, which are steroids, are toxic to the guppies at high doses. The hormones are normally added to the aquarium water and renewed on a weekly basis with a complete or partial change of aquarium water at each renewal. Using this method of treatment, we have found that the dosage of testosterone should not exceed 0.5 ppm if the fish mortality is to be reduced.

## (C) GROWTH

Growth in guppies has been found to be influenced by a number of factors. Firstly, the quality and quantity of food given are obviously important in determining the growth rate of the fish.

Secondly, a number of environmental factors appear to affect the growth rate of guppies. Salinity and temperature are two such factors. We have found that the growth rate of guppies in three salinities is in the order 1/3 sea water > fresh water > 50% sea water. Thus it appears that guppies grow best in 1/3 sea water or in fresh water with some salt (about 9 grams per litre) added. The growth rate of guppies also appears to be greater at  $30 \pm 1$  degrees C ( $86 \pm 1$  F) than at  $25 \pm 1$  degrees C ( $77 \pm 1$  F).

Thirdly, feeding of guppies with dried mammalian thyroid glands has been found to stimulate growth in some cases (see reviews by Pickford and Atz, 1957; Guruharan, 1969). We have made a more detailed study and found that the dosage of thyroid and the amount and type of food given are important factors to consider

if a consistent growth-stimulating effect is to be obtained. The dosage of thyroid should not exceed about 3% of the food and the food should be adequate and of the preferred type; otherwise, thyroid feeding may sometimes inhibit growth. Besides the effect on growth, thyroid feeding causes a number of other effects in the guppy, such as fin elongation and depigmentation (see review by Pickford and Atz, 1957). Our work in this connection will be published elsewhere (Lam, 1972; Menon and Lam, in preparation).

Fourthly, crowding, in general, has an inhibitory effect on fish growth (Yu and Perlmutter, 1970). The guppy is no exception (Rose, 1959). It seems that fishes produce growth-inhibiting substances which, in a crowded condition, reach a high enough concentration to affect growth. These substances have not yet been identified for certain (Yu and Perlmutter, 1970) but they may be the metabolic waste products themselves (Brookway, 1950).

Thus, it is best to avoid over-crowding guppies in an aquarium. However, if crowding is necessary for lack of aquaria and space, then the water should be filtered as well as changed regularly at short intervals of time, in order to remove as much growth-inhibiting substances from the aquarium water as possible. Some guppy breeders in Singapore follow the practice of changing one-half to three-quarters of the aquarium water each day. This is a good practice if one can afford the time and labor. If you are rearing other fishes besides guppies, it is probably better to keep the guppies together with the other fishes in a crowded condition than to keep the fishes apart (in a crowded condition) unless the fishes are not compatible with one another. This is because studies have shown that the growth-inhibiting substances produced by one species of fish does not affect another species (Yu and Perlmutter, 1970).

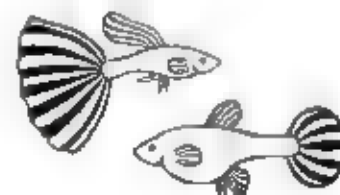
## (D) BEHAVIOR

Wiley (1966) has described the courtship behavior of the three guppy and the sexual response of the female. An interesting finding is that non-virgin females go through a cycle of receptivity which can be correlated with the cycle of brood production. Females respond most readily and are more likely to accept copulation in the few days following the birth of a brood of young. Virgin females are more persistently receptive until fertilization of the eggs occurs.

## (E) SEAWATER ACCLIMATION

The guppy can withstand abrupt transfer from fresh water to 50% sea water though not to full-strength sea water. However, if the transfer to sea water is carried out gradually in stages beginning with 50% sea water, the fish can be acclimated to live in sea water. In one study, guppies have been reared for 21 years in sea water (Daukoka, 1965). Thus the guppy is generally considered an euryhaline animal, i.e. an animal which can tolerate a wide range of salinities.

(reprinted from: Singapore Guppy Club's "SOLVENIR MAGAZINE" for 1972)



## ONE SURE THING LEARNED FROM THE GREAT GIS DEBATE

By Midge Hill

After many years I was able to locate an speak with Midge Hill. She and her husband, Floyd, moved out of state after his retirement. Midge is not active in the hobby, but I am sure she can be coaxed to write articles for the Roundtable. I am reprinting one of her articles from one of our past issues.

The great debate currently raging in many publications all over the country about GIS (Growth Inhibitor Substances) may leave us less than satisfied regarding the nature of the substance. If there is such a thing, but one visible fact has been becoming more and more evident as we follow the pros and cons of the discussions, which can be put to immediate use while scientists do further prodding into the whys and wherefores of the elusive GIS. Many very notable aquarists and researchers have entered these debates and virtually all of them, no matter which side of the GIS debate they come to rest, are in TOTAL AGREEMENT that **frequent water changes produce larger and healthier fish!**

Whether this is due to GIS, as some say, or whether it is caused mainly by the good, old-fashioned ammonium byproducts, or in fact anything affecting our water chemistry, would certainly be interesting and would surely make our work easier and/or more precise, but in the meantime, assuming that all these many people cannot be wrong, why not start at the other end and make use first of the fact that **FREQUENT WATER CHANGES PRODUCE LARGER AND HEALTHIER FISH!**

Having tried this myself over the past year, I can vouch for the improvement in these big show guppies who seem to really thrive on frequent water changes. Time was when all tank replacement water was aged in big storage liners which took up a tremendous amount of space in the fish room, and the thoughts of storing enough water to replace one third of the water per week in each of 50 tanks would bring gasps of, "No, I couldn't, possibly, there would not be any room left for the fish tanks themselves." Others, such as Dale Martecny (and who can argue with the fish HE grows) kept repeating, "It's easy, you just change 1/6 of the water twice a week and replace it with tap water direct from the house!" Having great visions of sick sprouting all over my gups from the adding of old water, I kept shaking my stubborn head, but somewhere along the line I finally worked up enough courage to try his technique. And lo and behold, wonders of all wonders, no sick, no disease, just bigger and better guppies! The 1/6 water change barely lowers the water in the tank 1 or 2 degrees, and the amount of ammonia in it is smaller and not enough to cause any problem to the tank's inhabitants, and is soon dissipated.

Another good trick learned from Dale, whose fishroom is the picture of efficiency, is to mark each tank with two lines, one indicates the 1/6 level to siphon down to, and the other indicates the refill level to replace up to. It works like a charm and you get precise measurements automatically each time.

So, no matter what it is you are siphoning out, bottom debris, ammonium byproducts, CO<sub>2</sub> excesses, sick baby guppies, or whatever, you will be ridding your tanks of the clutter lurking in the stagnant waters, and at the same time be adding a steady supply of fresh water and trace elements (which other leading aquarists claim is the main reason fish thrive on water changes anyway). No matter for what reasons, you come out ahead, and THAT makes sense!

Guppy Roundtable Jan/Feb 1995

## PURCHASING BREEDERS

By Luke Roebuck

When purchasing breeder guppies there is a good chance that a good chunk of your savings are involved. You need to be properly prepared.

Prior to making your purchases, you need to have a breeding tank prepared to receive your guppies. Most of the good quality guppies which are available from Jim Frank or myself can be started off under the same conditions since they come from hardy water. You need to have a 2, 2.5 or 10 gallon bare tank cleaned, sterilized with bleach solution and rinsed and refilled with clean tap water at least 24 hours prior to your purchase. The water should be conditioned with 1 teaspoon of rock salt per 5 gallons of water as a minimum. I also recommend 1 drop of formaldehyde per gallon and also 1 capsule of Spectrogram antibiotic as an overall disease preventative during this stressful period for the fish.

Filters should be box and/or sponge corner type. "Chore Girl" brand pot scrubbers can be used as a safe haven for your fry. I personally use clean, disease free Java Moss live plant clumps in my breeding set-ups. It helps with cycling the tanks to eliminate poisonous waste.

Float the bag in the tank and open and fold back the top to trap a column of air to allow the bag to float. Use a turkey baster to remove from 1-3 oz. portions of the bag water and throw this water out. Replace with an equal amount of tank water.

Allow the fish to acclimate for 15 minutes. Repeat this process several times, then gently tip the bag over to allow the fish to escape. Do not feed for several hours, only then a light feeding of brine shrimp. Resume normal feeding schedule when they have eaten the first meal and are swimming to the front of the tank for food. If the breeders are from good, healthy stock, you should be rewarded with fry in one to two months.

IFGA Bulletin May 1997

## 10 IMPORTANT TIPS ON RAISING SHOW QUALITY GUPPIES

1. Start with the best available stock you can find.
2. Set up a breeding plan as to what you want to achieve, which shows, when, etc.
3. List the number of tanks you will require to achieve your plan.
4. When the first batch of fry arrives, make sure you start feeding them brine shrimp immediately. Make sure they start feeding.
5. Watch the feeding and let them eat until their bellies are full.
6. Change 25%-30% of the water every two to three days.
7. Make sure your fry are active and eat ravenously at the next feeding.
8. Feed a variety of dry & live food - #1 brine shrimp.
9. Cull out slow growers.
10. If the entire batch is listless and don't eat at feeding time, dump them and go to the next batch. They will never get to show quality size.

IFGA Bulletin December 1996

## ARTIFICIAL INSEMINATION OF FANCY SWORDS, VARIATUS & MOONS

by Glenn Takeshita

**ED'S NOTE:** And it just might work for gups too.

Since the introduction and the rapid development of different strains of fancy swords and platys, much experimentation with these fishes has been done. Through these experiments have developed many techniques to insure the perpetuation of the different strains of fancy swords and platys for many generations to come. I would like to present one of these techniques to you.

In this article, the technique of artificial insemination of fancy swords and platys.

Several articles through the years have appeared in several different publications on this subject. Many of the articles were so sketchy and general that they lacked the essential information to put the technique into practice. Other articles gave just enough information so that the curious, advanced hobbyists were encouraged to experiment with the technique. In 1969, at the height of the lyretail swordtail craze, I decided to experiment with this interesting technique. In this article I wish to share with you the finer points of the technique which I gained through my own experimentation.

I learned later that the technique of artificial insemination of swords and platys was not new at all, for it was practiced routinely for many years in laboratories, where genetic experiments on these fishes were being done. But to us hobbyists who lacked the formal training and equipment, it was really a new and exciting technique to experiment with.

Before presenting the technique to you, I would like to mention why I decided to experiment with it. The main reason why I wanted to try my hand at artificial insemination was that I knew the male lyretail sword was incapable of impregnating the female because of its very long and highly modified gonopodium. I wanted to breed lyretail to lyretail to see if I could increase the percentage of lyretail young or preferably arrive at a fixed strain which could throw 100% lyretail young. Secondly, through artificial insemination I wanted to create the lyretail variatus and lyretail moonfish if it was at all possible. With these two goals in mind, I began my experimentation on artificial insemination. The following step by step procedure was one which I developed through my own experimentation over a period of several months.

(1) I did not use an anesthetic as recommended in the previous article. I tried using Metab-o-fix at the recommended concentration but the males never recovered from the anesthetic. I never tried quinaldine or MS222 because they were not available to me.

(2) I used an ice tuberculin syringe with a No. 26 needle with the tip ground straight, to remove the sharp point. Others recommended a needle of larger size, either a No. 20 or 22.

(3) I worked on a small, wet piece of wonder wool.

(4) I netted the male lyretail sword and placed him on his back on the wet wonder wool. Since I am right handed, I placed the head toward my right. Holding the fish with fingers of my left hand, I then gently with the thumb and first finger of my right hand stroked the belly of the male from the dorsal area of the location of the testes toward the anal opening and the base of the gonopodium.

If the spermatophores (small packets that carry the sperm) were present, they immediately started flowing out from the genital pore. By moving the gonopodium with the fingers of my left hand through a 180° swing from the head to the tail, the rate of flow of spermatophores was increased.

(5) Then, holding the male with my right hand I used my left hand to draw up the spermatophores with the syringe.

(6) I then returned the male to a gallon jar which had some antibiotic added to the water so that the chance of the male getting an infection was prevented.

(7) I then quickly netted the virgin female and placed her on her back with her head toward my left. I held her in this position with the fingers of my left hand.

(8) I then gently located the genital pore, which is situated just anterior to the anal opening, which in turn is anterior to the anal fin.

(9) Next, I inserted the tip of the needle about 1/16-1/32 of an inch into the genital opening and carefully injected the spermatophores. I held the needle at a slight angle so that the excess trapped and could be discharged.

(10) I then placed the female into a separate gallon jar with water that had some antibiotic in it to prevent infection.

(11) The syringe was purged with hot water between inseminations when I changed males for the milking step.

The most important thing to learn in the artificial insemination technique is applying just the right pressure during the milking procedure to get the spermatophores. In the beginning I applied too much pressure and this killed the males by evidently causing rupturing of some of the internal organs. Actually, the touch will come with practice. Also, always work with moist fingers so that at time removal from the fish will be kept at a minimum. Since the spermatophores are easily seen with the naked eye, the use of a microscope is not necessary, but if you have one, it will make things a lot easier. Working with a microscope at a magnification of 10x is ideal.

I found that no anesthetic was necessary. Just be sure to work with firm but delicate fingers when holding the squirming fish. If the fish is overly active, you can gently wrap the moist wonder wool around the fish. This will give you a better hold of the fish and working time will be increased because the fish is kept motionless during the finger manipulations to get the spermatophores.

I would strongly recommend practicing on some male lyretail sword to get the feel for the milking process. This way you can lose a few fish and develop your technique.

I also found that the so-called rusty lyretail sword males were the ones that were generally fertile and had a lot of spermatophores. The very large and beautifully finned lyretail sword males are generally sterile with no spermatophores, therefore recommend that you first start practicing with these rusty lyretail sword males. If you are going to try artificial insemination.

The most important step in the whole procedure is to be sure that the females are definitely virgin. Also, after the insemination, keep the female isolated in a 5 gallon tank for at least several months to be sure if the insemination was successful. If the artificial insemination was successful, you should get at least 2 or 3 batches of young from the female. Some females will give you as many as 5 or 6 batches of young at approximately monthly intervals.

At the start of my experimentation, I had very poor results but as I gained experience, especially in the milking process, the results got much better. Actually, my first few lyretail variatus and moon sword hybrids were gotten from my artificial insemination experiments. Both variatus and the moon parents were non-lyretails. The male parent was a lyretail sword. The female hybrids gotten were then bred back to either variatus or moon males to try to develop and fix the lyretail variatus or moons.

During my artificial insemination project, several incidental natural crossings between the lyretail sword female and the hufin variatus and the hufin moon males occurred in other hobbyists tanks in Honolulu. It is these natural crossings that I wrote about in my articles on the lyretail variatus and moons that appeared in several of the hobbyists magazines. At this particular time I did not do any articles on my insemination experiments because my results were only marginal. To be more exact, I have successfully crossed Xiphophorus artificially approximately a dozen times. I did write to Dr. Joanne Norton about my insemination techniques which she asked me to revamp into an article for Livebearers which I am doing now.

To make this article complete, I would like to discuss the important items which need some clarification. **The first item** is the term superfecundation...some people have questioned the validity of the definition of this term. My investigation of this term has shown that it was properly used in the previous article. Superfecundation is defined in physiology as the ability to conceive a second time or several times while still pregnant from an earlier conception. **Item 2...** In some of the earlier articles on the breeding of swords and platys, some people have recommended shortening the gonopodium by surgical means to enable the males to copulate normally with the female. Some have claimed that males altered this way were able to fertilize females to produce young. I am definitely against such procedures on the fish for the altered gonopodium lacks the claw and hook structure which is needed to make proper contact for copulation. **Item 3...** If you use sperm from 2 different males to inseminate a virgin female, you definitely may get a mixed breed of young. Therefore, I purge my syringe with clean water inbetween to prevent cross contamination.

Most hobbyists feel that artificial insemination is only for advanced hobbyists. This is not so. Please try your luck with this interesting and fun technique.

reprint from Texas Aquar, Vol., 4-5/70



Glenn Takeshi is a retired assistant chief water chemist with 35 years of service with the Honolulu Board of Water Supply. He attended the University of Hawaii and Indiana University. Glenn has raised fish all his life, and became a serious hobbyist in the 1950s. He started writing fish articles around that same time. He plans to keep writing as long as he is able to. Glenn's forte in the tropical fish hobby has been in fancy livebearer genetics. He also has many other interests, including karate, sports, plants, birds, body surfing, surfing, and he loves dancing. (Bio taken from TFH Magazine authors and columnists)

## CAESAREAN OF A DEAD LIVEBEARER

BY JOANNE NORTON

Many amateur aquarists have been disappointed by having a female livebearer die shortly before she would have had young. Occasionally aquarists have obtained livebearer babies by cutting open live females about ready to have young. However, since depletes the supply of female breeders, I have never used this method.

Probably it is not generally known that it can be possible to get live babies from a dead female livebearer that is cut open soon after she dies. I had one of the Poecilia species that was about due to have young when she died. She was alive in the morning, then found dead two or three hours later. I did not know how long she had been dead, but knew it was possible that it had been only a short time. Therefore, I cut her open with a razor blade and then squeezed the young out into a net that was in the water. Most of these premature young still had considerable yolk sac, but two or three were further along in their development and one of these moved when disturbed. The young were kept in the net to protect them from snails. All of the babies except one died, but within a day the one surviving's yolk sac became absorbed and this baby grew to a healthy adult.

The percent of successful caesareans of dead fish probably will be low but will work only if the embryos are far enough along in their development and if the female is found soon enough after she dies. I do not know how soon this has to be. I have opened a number of dead females without getting any live babies, and suspect that in most, perhaps all, of these cases the female had been dead too long, resulting in death of the young.

A caesarean is not recommended for every dead female livebearer, but rather is suggested as an occasionally useful method if the survival of fish is valuable or in short supply. If you have a valuable female that dies when about to have young, it might be worth trying a caesarean on her. You would have nothing to lose since the female is already dead, and perhaps you can save some of the young.

(Reprinted from "Amateur", Oct. 1970)

Editor's note: I have tried this operation on dead guppy females a number of times. Most often the fry are dead. If too premature they die shortly even if they are alive at the time of the "delivery" or at best one or two will make it as in the case described above. I have also found that sometimes those that do survive remain weaker and never fully develop and mature as would be expected of fish of that particular strain. However, if the timing is right all the way around, this can be a very valuable way to save an important batch of fry. At this very time I have a batch of about 14 young fish that were taken from a dead female from a strain that is not very prolific (I worried these babies had y). With the exception of one or two "belly slingers" the fish are developing normally. However, it might be added that when they were first removed from the mother, I was necessary to nudge each one to get them to uncurl into the swimming position. Those that were left curled up did not uncurl by themselves and soon died.

## The Function of Body Slime in Fishes

by Bob Fenner

(The following is a summary of a Program presented in March at the SDTFS general meeting and September at the San Diego Kai and Greatfish Society).

All living fishes have body slimes, a mucoid covering on their very outside. This seems to be the primitive condition, that all ancestral fish also possessed body slimes.

First of all, where does it come from? From dispersed glandular cells, not from mucous glands in the epidermis. The type and placement of these glands are of importance in classification. These cells produce a glycoprotein called mucin that mixed with water makes mucus. As an example, think of a hagfish, psychrolute goby (muraena) or some species of eels, who are very slimy.

**General structure of the skin:** The skin of fishes, like that of all vertebrates (amphibians, reptiles, birds, and mammals), is of two principal layers

1. a superficial (relatively thin) epidermis, and
2. a deeper dermis

The epidermis is of two or more layers. The deepest is of close-packed, discrete cells--the germinal layer (mitotic germinal layer). The outer cells are formed by its daughter cells. There is much variation in the outer cells, dependent on the group of fishes. Body slimes are the products of these daughter cells and their degradation products and, as such, are continually replaced. The old materials are sloughed off and reabsorbed by those underneath.

The dermis is dense connective tissue with two basic layers. It is thicker and more stable than the epidermis.

**What the slime does for the fish:** The fact that all fishes have these body coverings is some indication of their importance. Without this slimy coat or too much of it, any fish will soon die. The slime serves three main functions for all fishes. It may be

**1. Osmoregulation**--It provides a selective interface to maintain internal-external ionic balance. One of the reasons fresh-water fishes are constantly urinating in their homes are "saltier" than the water around them and tend to absorb water. The fish gets rid of this extra water by elimination. The opposite rationale holds for salt-water fishes. In addition to salt balance, the slime plays an important role in dermal respiration. That's right--fish breathe through their skin, so do humans. If the amount and/or quality of the slime changes, it affects the efficiency of gas transport.

**2. External Protection**--The slime prevents attachment of ecto-parasites by making the surface on the fish slippery, sloughing off with the parasite, and suffocating the pathogen. It also acts as a bandaid by covering over a wound caused by infection or mechanical injury. Usually fishes with poorly developed scales are more slimy, e.g. characins (tetras) and their relatives.

**3. Reducing Turbulence**--Especially in fast moving fishes the drag resulting from small spaces between scales and projecting body parts allows for a considerable energy loss in locomotion (up to 30% by some estimates). The slime smooths out these spaces.

Outside of the three above "biggies" many groups of fishes benefit in other ways from their slimes. For some they help

**4) Coagulate Particles**--Provide clean water in the immediate area around the fish, thus improving movement and dermal respiration. Some filter feeding fishes pass the mucus up forward into the mouth and eat it with the collected particles utilized as food.

**5. Produce Toxic Slime**--As an example, some of the hagfishes, closely related to the lampreys that have ruined the fisheries in the Great Lakes, immobilizes a host fish on contact with its body slimes, climbs inside and eats it! Also a good example is a sculpin found in the Red Sea, *Parurochirus marmoratus*, featured in an article in the November 1974 issue of National Geographic. This fish's slime contains a substance so effective in warding off sharks that the attacker's jaws are said to be frozen in mid-bite with contact with the fish's skin.

**6. Cocoon Formation**--The African lungfish, as a well-known example, avoids desiccation during summer and dry periods by making a shell of its body slime and hibernating.

Many parrotfishes, family Scaridae, produce a mucus "tent" at night to protect themselves from predation. As an experiment, some of the parrotfishes of the genus *Scarus* which construct such "sleeping bags" and an equal number of a similar species of the genus *Sparisoma* which do not form cocoons, were placed in a tank with a few moray eels. I, seeing parrotfish are a favorite food item of morays. These fishes were left together overnight. The *Scarus* built cocoons and were not eaten, but all of the *Sparisoma* were consumed. During the night the morays were observed approaching the camouflaged *Scarus*. Though they couldn't see what was contained within the opaque containers, it was evident that they understood what was refused there in. The eels sampled the mucus and left the *Scarus* alone.

**7. Feeding**--Several fishes, including some of the genus *Mystus* (some Asian catfishes) and the discus (*Symphysodon*) secrete body slimes to feed their young. From Brian Walker, Aquarium, July 1969: "baby discus feed on an overabundance of slime which develops on the sides of the parent fish at breeding time. The substance is highly protein in nature and is produced by specialized skin cells. This situation is not the same as in mammals--the 'milk' of a different chemistry and there is no permanent organized structure for secretion. This is an important source of food for the young. They need it for the first week, at least. There are no suitable naturally occurring substitutes."

**8. Alarm Substances**--A lot of aquarium fishes--tetras, barbs, sharks, ramboras, loaches, catfishes and others--have a number of club (hemocytes) that is, they have no direct opening to the outside) that, when the skin is broken, release a fright contagion (signal, that notifies others in the area that something is going wrong. These substances are not specific for the species alone. They are responsible for producing the fright syndrome the Germans refer to as "shrekschiff". Symptoms of this condition are fear without apparent cause; the fishes dart about the tank bumping into everything and hide in dark corners. The only cure is chemical filtering or near complete water change.

As can be seen from the previous discussion, body slimes are very important to fishes. By affecting its amount, greater viscosity stress is created on the fish.

What can you do? Take care when netting. Commercially, we never touch fire-scaled fishes with hands. If a fish drops to the floor pick it up with a wet net.

Metallic-ion medications, among others, act as proteinaceous precipitants, making the fish produce more and more slime with increasing irritation. From Glenn Takeshima, Aquarium, July 1969: "In respect to the fishes, the copper ions (like in noxib, coppercure, etc.) react as an irritant to the skin and gill membranes of the fishes which in turn produce a copious amount of mucus to protect these tissues. (On

If disease organisms are present on these tissues, the mucus which is produced engulfs these organisms and when the mucus is sloughed off the disease organisms are sloughed off also."

Under high or prolonged treatment with such medications, there results loss of fish due to direct take-up and mucus production so great as to impede gaseous exchange by gills and skin.

Once again, the best policy to maintaining aquatic life is not to change too much too quickly and select for a suitable environment. Change water frequently, vary the diet, and watch what you put in the tank.

Reprinted from *The TROPICAL BREEZE*, December 1973, published by the San Diego Tropical Fish Society, P.O. Box 436, North Park Station, San Diego, CA 92104.

**Bob Fenner** is a lifelong aquarist with an active and continuing involvement in the academic, journalistic, trade, and hobbyist sides of aquarium keeping. He is a former marine science and aquariology instructor at the University of California and in the California State University system.

Bob is the author of *The Conscientious Marine Aquarist* and has been a regular contributor to a number of aquarium publications, including *Freshwater and Marine Aquarium*, *Tropical Fish Hobbyist*, *SeaScope*, *Pet Dealer*, and several foreign hobbyist and business periodicals. He has been a speaker and judge at many aquarium conferences and events, with subjects ranging from evanescence collection of reef fishes to coral sheet collecting, and environmental aquarium trade, hobbyist, and scientific topics.



## HOW DO FISH GILLS WORK?

Author Not Given

Gills work like lungs, with one slight difference. Both exchange waste carbon dioxide for fresh supplies of oxygen. The operations are so similar that it seems strange that we cannot breathe (in) water and fishes cannot breathe air. However, remember that one slight difference.

The gills of a fish depend upon a fantastic chemical called hemoglobin. Its molecules are crammed into the floating cells of his fishy blood. Of course, our own blood cells also contain hemoglobin. In both cases, the blood is colored by the hemoglobin in the swimming red blood cells. In both cases, the molecules of hemoglobin perform the same marvellous duties. They gather up molecules of oxygen, tote them around and deliver them to the body's living cells. These cells use oxygen as fuel to carry on their vital activities. In the process, they create waste carbon dioxide. The circulating hemoglobin in the red blood cells gathers this trash and carries it away for disposal.

Air breathing lungs are spongy tissues where minuscule blood vessels come close to the surface. The walls that separate lung cells from the air are so thin that gases can pass right through them. Blood cells circulating back to the lungs give up their waste carbon dioxide to be breathed out. In exchange, they grab fresh supplies of oxygen to be toted on another life-giving excursion through the body. The swapping of gases is done through the tissue thin walls of the lung cells. The gills of a fish make the same exchange of gasses through similar tissue thin walls.

A fish's gills are more or less where you would expect to find his ears. These fragile tissues are shielded under firm, tough plates called gill covers. The true gills under the covers are fine, soft threads, colored pinkish red by blood vessels that come close to the surface. The cells of these threads are so thin that gases can seep through them.

As you watch a fish, he seems to be gulping endless mouthfuls of water. Actually, the water is pushed through channels that lead from his mouth to his gills. As it washes between and around the fine, feathery gill-fringes, the hemoglobin in the red cells give up its carbon dioxide and grabs fresh supplies of oxygen molecules. Then the used water flows out the back way of the gill covers. Gills can absorb only gases that are dissolved in water. Lungs can absorb oxygen only from the gaseous air. If gills and lungs could reach each other, we would be able to breathe under water and fishes could breathe in the air.

The hemoglobin molecule can do its magic because it contains an interesting bio-chemical substance called Heme. Heme contains iron atoms arranged so as to make it mildly attracted to oxygen and carbon dioxide. When hemoglobin is near these gases, the Heme molecule links fingers with them. Each molecule of hemoglobin forms four loose ties, easily broken when the time comes to swap its carbon dioxide molecules for molecules of fresh oxygen.

Reprinted from *Citrus News* 9/72



## Research Projects

## General Procedures For All Projects

**FISH:** Unless otherwise stated in specific project outlines, there must be an equal number of fish, preferably from the same batch of young, in each tank involved in the test. If filters are not large enough, fish from two different filters may be used as long as the second filter is also divided equally between the test tanks. If a fish should die in one tank, a fish must be removed from any other tanks in the test project so that numbers of fish remain equal at all times. No medications or water additives should be used (unless so specified). In case of dire necessity, medication may be available but all tanks must receive an equal dosage of the medication whether they show signs of illness or not.

**TANKS:** The size tanks advised for different projects will be listed in the particular project outlines. The important thing is that all tanks involved in a particular test should be the same size with the water level marked on the side so that each can be accurately maintained at the same level. Any exceptions to this rule will be noted in the specific project outline. The tanks involved in the test should be located close by side so that any differences in temperature, lighting, etc., will be minimal.

**FILTERS:** Filters should be of identical size with filter mediums carefully measured to assure that all tanks in the test project have the same filtration power. Refer to specific project outlines for further information as to sizes, types of filtration materials, frequency of changes, etc.

**WATER:** Unless otherwise noted in a specific project, water for all test tanks should come from the same source and be of the same temperature. Frequency of water changes will be specified for each test project but will usually be of identical measurements changed simultaneously for all tanks in the test. Replacing water lost to evaporation should also be done to all tanks at the same time. Use no water additives unless so specified in the outline.

**PLANTS OR SCAVENGERS:** Unless otherwise stated in the project outline, no plants, ornaments, snails, catfish or other scavengers are to be used in test tanks.

**FEEDING:** If not specified in the test project, feed the foods you normally use but carefully measure amounts so that precisely the same amount of food is given to each tank. (Baby brine shrimp can be measured by straining them through a net. The suspended shrimp can then be accurately measured by weighing them up in a measuring spoon.)

**RECORDS:** Some sort of record card should be kept handy where it is easy to note any observations. Record everything you see no matter how inconsequential it may seem at the time. The oddest things sometimes count the most in the end! Information required for all test projects is:

project name and number	type of filter
date started	exact measure of what filter mediums,
age of fish	source and pH of water
color strain of fish	temperature of water
number of fish	type of lighting and number of hours on
size of tank	feeding schedule and types of food fed
exact measure of water in tank	specific information as required by project outlines

THE EFFECTS OF FEMALE HORMONES  
ON THE FERTILITY OF FEMALE GUPPYS

**GOAL:** To discover what effects female hormones have on female guppies, especially in regard to fertility.

Please read the general procedure for research projects before going on to the specific procedures set up for this project as the general instructions apply to all projects unless exceptions are stated in this project outline.

- 1. Tank set-up:** 5, 10 or 15 gallon tanks are acceptable for this project (10 gal. being considered the best) as long as Tank A and Tank B are of equal size with the same measured amount of water (see general instructions). Excellent filtration power is especially important in this project as hormones are subject to filtration. Try to use a minimal amount of filtration. Box filters of equal size should be used for Tank A and B as the type of filter medium used can be vital to the evaluation of this experiment. Please make careful notes regarding the exact measured amount of filter medium(s), what kind of mediums used, etc. Filters will not be changed during the hormone treatment stage of this project but when changes are allowed, the frequency should be carefully noted. See general instructions for water. No water changes are to be made in either of the test tanks during the hormone treatment period.
- 2. Fish:** We would like eventually to see this experiment carried out on females of any different age groups from two weeks to one or more years. However, all females used in any given test should be of the identical age, and it is important that all females be virgin at the time the test begins. Females should be from the same litter (see general instructions if this is not possible). As soon as sexable, select from 10 to 25 females from the same litter and divide them equally between Tank A and Tank B. If older females are being used, please indicate their age (in days) at the start of the testing.
- 3. Feeding:** There are no special feeding instructions for this project so use any food or foods you normally use but carefully measure amounts, so that each tank gets precisely the SAME AMOUNT and KIND of food (see general instructions).
- 4. Records:** Fill out your record cards with the initial information as specified under the general instructions. Keep these cards readily available for frequent notes on observations.
- 5. HORMONE TREATMENT:** Begin by adding to Tank A, 1 cc of estrone per gallon of water (1 cc per 10 gal. water). Do not add any hormone to Control Tank B. Repeat this dosage every 5th day for four treatments. During this period, do NOT change filters, do NOT change water except to top-off to the line of measurement, as water is lost by evaporation. Make frequent note of any differences in appetite, growth, etc. between the two tanks.

On the 7th day following the fourth and last hormone addition, remove exactly one-half of the water in each tank (measure accurately) and replace to water level line with aged water of the same temperature. Beginning 7 days later and continuing until the end of the test project, change 1/4 of the water in both tanks every week. The hormone treatment stage of this project is now complete.

- 6. Breeding stage:** On the same day of the first 1/4 water change, two weeks after last hormone addition, change the filter medium and add one active male guppy to each female guppy in each of the two tanks. Continue to change 1/4 water weekly and replace filter medium as needed in both tanks at the same time in every instance. Make note of each water or filter change on the record card. Continue to observe and note any differences, similarities or whatever between Tank A and Tank B inhabitants.

7. **Maternity stage:** On the 19th day after the males were added, remove each female from Tank A into a nylon net breeding trap suspended not more than halfway into a drum bowl (or any other suitable container) filled 3/4 full of water from Tank A. Carefully label each female (A1, A2, A3, etc.). Repeat this process for each female from Tank B. After each female drops her fry, return her to the tank from which she came (which still contains the males). Record the date of the dropping and the number of fry produced. If a female has not dropped fry by the 40th day after the males were introduced, clip a corner off of her tail (for identification purposes) and return her to her home tank and, make a note to the effect that there were no fry. Continue this maternity isolation and counting of young at least until after the dropping of the 3rd round of fry...taking special care to observe any females who have not dropped young or do so belatedly. Those with the clipped tail. All young produced may be disposed of in any fashion you choose. Once counted and recorded, they are of no further concern to this test project.
8. **At the end of the test period** (which will be even more valuable if carried to the 4th or 5th round of young) "total the number of fry dropped by each batch of females (A and B). How many females in either A or B did not ever drop fry? From which tank did the female dropping the largest litter come? Is there any difference in size, behavior, color or anything else between A and B females between embryos within each individual tank?"
9. **Turn a copy of your records over to the PPGA Research Committee** but PLEASE maintain tanks A and B as set up until the Research Committee indicates that these fish will not be needed for the gathering of any additional data.  
(Corresponding members: We are sorry but the law will, not allow us to provide you with the hormones used in this test. Ask your local veterinarian or doctor if he will provide you with the necessary prescription for this experiment. Ask for injectable estrone, .2 mg per cc, preferably accompanied by 1 mg per cc of potassium estrone Sulfate. If you use any other female hormone please give full generic name and data in your report.



## PPGA RESEARCH COMMITTEE RESEARCH PROJECT #2-73

### THE EFFECTS OF USING TRACE ELEMENTS ON GUPPYS

**GOAL:** To investigate what effects trace elements added to the water have on the growth and development of guppies.

**NOTE:** Please read the general procedure for research projects before going on to the specific procedures set up for this project. The general procedures apply to all projects unless specific exceptions are stated on this page. Include

#### TEST PROCEDURES FOR RESEARCH PROJECT #2-73

1. **TANK SET-UP:** Two 5-gallon tanks are suggested for the initial stages of this project. The entire project may be carried on in 5-gallon tanks or the fish may be shifted on to 10's or 15's after the first 4 weeks (if desired). Dates of any shifting-on should, of course, be carefully noted. Tank A will be the test tank and Tank B and control tank in all cases. Refer to the general instructions for filters and water as there are no specific instructions specified for this item.
2. **FINISH:** Divide 1 liter of guppies at birth into two equal groups. (See general instructions of division does not allow at tank 5 fry per cent tank. Note date of birth on your records.)
3. **FEEDING:** There are no special feeding instructions for this project so use any food or foods you normally use but carefully measure amounts so that each tank gets exactly the same amount and kind of food (see general instructions). Careful measuring is important to the results of this project.
4. **RECORDS:** Fill out the record cards with the initial information as specified under the general instructions. Keep these cards readily available for frequent observations and notes.

#### STAGE ONE - BEGIN TEST

5. **Prior to putting the test fry into the test tanks,** add trace element mixture to tank A in ratio of 1 cc per 5 gallons of water. Do not add any trace element solution to Tank B. (If you normally use salt in your guppy tanks, it is permissible to add the normal amount of salt equally to both tanks, but make careful note of this fact and the exact measurement and type of salt by brand name). Water will be changed at the rate of 1 gallon measured, per week for the first 4 weeks. Replacement water should be changed with the trace elements for Tank A at the rate of 1 cc per gallon of water.
6. **Maintain these tanks for four weeks** with all other factors being kept equal. Whenever you do something to one tank, the other must receive a same treatment. Measure food accurately. Use no medications. Make frequent notes on observations of any differences of appetite, growth, activity, signs of maturation, when males first show color, etc.
7. **At the end of the first 4 weeks,** the fish may remain in the 5-gal. tanks or be shifted on to 10 or 15 gallon tanks. Continue to change water at the rate of 1/5 per week, always being sure to recharge Tank A With trace minerals at the prescribed rate. All other factors should remain constant. Observations of any differences at all between the two test tanks should be carefully noted. Make note of age when females drop their first fry...remove fry from test tanks immediately.
8. **Conclusion:** At the end of four months from the date of birth the test can be terminated and the records turned over to the PPGA Research Committee for evaluation, but please maintain Tanks A and B as set up until the Research Committee indicates that these fish will not be needed for the

gathering of any additional data. For maximum results, however, we would be grateful if you could maintain these two tanks of fish under test conditions until they are 6-7 months of age - at which time they should be fully developed and any latent effects of the trace elements can be ascertained. Are there any long-term differences in growth, overall health, size, color, etc., etc. Also note any deformities, fertility differences, etc.

#### SIDELINE TO RESEARCH PROJECT #2-73

During the time you are using the trace element's mixture, try adding 1/2cc per gallon to your brine shrimp hatcher. Do you notice any difference in the percentage of hatch or the size of the shrimp? This will not be a controlled experiment, but if any differences are noted, this can be a likely subject for future research projects. Others have found the use of sea salt an advantage to brine shrimp hatching. Will the addition of the trace elements to the standard sea solutions for brine shrimp have the same noticeable effects???

Corresponding members who wish to conduct this experiment in their own tanks may obtain the trace element solution from the PPGA Research Dept. for \$2.85 plus 50c postage and handling - Cal formula residents please add 5% sales tax. \$1.00 of this drug will be returned to you sending in results of your tests to the PPGA Research Committee. 9901 Cinda Dr., Whittier, Calif. 90603, in time for inclusion in the addendum material of the official Research Department report.). ###

#### THANK YOU

Our thanks to the following firms for their support of PPGA

Koroon Corporation, Hayward, Calif.

Pacific Aquatics, North Hollywood, Calif.

J's Tropical Fish & Pet Supplies, 10935 E. Imperial Hwy., Norwalk, Calif.



## GUPPIES & HORMONES

by Vince Mascolo

As we know, the colors and the large caudal and dorsal fins of guppies are sex-limited. The female has little or no color in all but the most highly developed strains. By the use of synthetic derivative of the male hormone TESTOSTERONE, we can determine the characteristics she will contribute to the genetic make-up of her fry. At times this drug is used to bring the colors out in a female prior to entering the pair in a show. Although I am not condoning the use of TESTOSTERONE in this manner, I will attempt to explain the proper use of it both for applications.

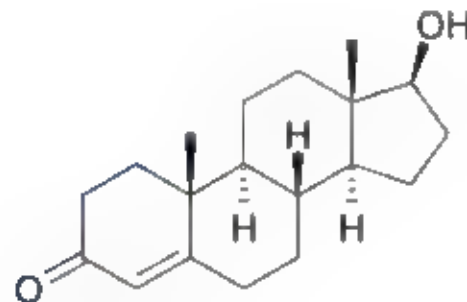
The drug is most commonly used in the methyl form. A stock solution for determining the color carried by the female guppies may be made by dissolving 100 mg of methyl-testosterone in 1/2 cup of 70% alcohol. Put this in a quart container. Fill it with water, and shake well.

Put 2 drops per gallon in the tank and repeat for 2-4 weeks stopping as soon as color develops. The effect of the drug lasts up to 6 weeks, depending upon the size of the female. When used for a prolonged period of time, sex-reversal and/or sterility may result. To help reduce the chances of this in any half-grown females should be used.

When used to bring the female to the fullest possible color, start with large adult females. Use the same dosage as above but treat the fish for 5-6 weeks. If the female is fully matured and large this should not be a long enough period of time for sex-reversal to start. The female will have maximum coloration for 1-2 weeks after which the intensity of the colors will decrease, until the female returns to her original state. By treating the females in this manner they will most likely be sterile so do not attempt this with your breeders. ###

Reprinted from MODERN AQUARIUM published by the Greater City Aquarium Society

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## SHOULD WE TREAT FISHES WITH HORMONES?

by Joanne Norton

Years ago hobbyists started treating guppies with the male hormone testosterone to bring out color in the females. This was, and still can be, a useful tool in guppy breeding, as it enables the aquarist to select the females that have the desired color in the caudal and dorsal fins. I have treated both female guppies and female koi fish with testosterone. Now, however, many people treat females to make them more colorful for show or sale. In my opinion, treating fishes with chemicals to make them more colorful for either commercial or show purposes is wrong and bad for the hobby. Nevertheless, this treatment is being done on a wide scale and is likely to continue because it is profitable and difficult or impossible to prevent. Some of the fish species other than livebearers that have been treated are the colorful baby daisies, "green" angelfish, red baby Oscars and, most recently, the red orange chromides. All of these are colorful, expensive and fade in a few weeks or months.

Even color testing female guppies may have drawbacks. In some guppy strains the females may have much natural color without being treated with hormone, but this color may not develop until the females are past several months of age. If you always select your female guppy breeders from immature testosterone-treated ones, you may be picking the ones with the brightest color but you may miss the ones that would develop caudal and dorsal color naturally at five months or later. It could be that the most colorful testosterone-treated females would become the most colorful with no treatment, but we do not know this. Therefore, my tendency with many of today's guppy strains would be to not treat the females, although there might be exceptions with some strains.

I do not know of any evidence that a female guppy's color is suppressed by her own hormones. Instead, the usual situation is that much of the color expression in guppies occurs when the male hormone concentration reaches a certain level. I do not know what the hormone level is in female guppies but develop natural color in most of the caudal. I have raised female guppies that had a great deal of color in the caudal and dorsal and I know these were not treated. Some guppy strains today have females with very large and colorful caudals. I do not know what percent of these have been hormone-treated but we know that some are. I have heard of males of guppies in which females with large colorful caudals (similar to that of a male) are produced naturally. The disadvantage of hormone treating females to "improve" them is that it is cheating. If they are used for show and also it is misleading for people who want to acquire a good strain. I have seen many imported guppies that I think were treated, because the females had not only a large and colorful caudal but also an anal fin beginning to develop into a gonopodium.

It has been mentioned in fish bulletin articles that fertility of female guppies can be improved by treating them with female hormone. We should remember, but not all fertility is due to any problem involving female hormones in the female. I once had a strain of red guppies in which it was difficult to find a bred female in a tank full of males and females that had been together for several months. Yet, when I put some virgin females of this strain with males of another strain, they all became pregnant.

Thus it appeared that the low fertility in this red strain was likely due to a problem with the males, not hormone levels in the females. I never tried treating female guppies with female hormone, and would like to see the results of continued experiments.

From the preceding article\* you can see that larger male guppies result by treating young ones with Stilbestrol. I have suspected for several years that the very large platy imports were produced by this method.

Stilbestrol has been used on fishes to make more money or to win at shows. The aquarist who is interested in maintaining and improving livebearers should never treat any with Stilbestrol.

In conclusion, I feel that most present uses of hormones on fishes are undesirable and deplorable. The exception, in livebearers, is the use of testosterone for color testing female guppies of certain strains, for specific information that cannot be obtained without treatment. \*\*\*

Reprinted from LIVEBEARERS, May-June, 1977 (#33), published by the American Livebearer Association, 2305 Broward Ave., Ames, Iowa 50010.

\*This refers to "SELECTION OF FEMALE BREEDERS BY COLOR TESTING" by Arnold Setz, published in the August 1976 issue of Guppy Roundabout.

Editor's Note: The author omitted my major peeve with the use of hormones, namely that those big, beautiful male and female guppies, made that way through the use of hormones, are almost invariably sterile. The excessive use of hormones destroys the reproductive organs. Most of us that buy guppies expect to breed them and should feel robbed if they won't breed.

\*\*\*\*\*

Dr. Joanne Norton

Oct. 2, 1926-July 16, 2005

Famed aquarist and author who founded the American Livebearer Association, wrote many articles in *TLH*, *FAMA* and others about genetics, angelfish, livebearers, cichlids, koi fish and more.

Dr. Norton was responsible for most of the fancy strains of Mollies available in the hobby today, as a result of her genetics experiments. She worked with other livebearers as well, and was one of the first to determine the inheritance factors of the various mutations of Angelfish.

## ANYONE FOR HORMONES?

by Ginny Lay

Much has been said---and done---on the subject of "Hormoning" fish in the past, but we tend to forget that new people are coming along and the time and perhaps they would like to kick this topic around a little for themselves. For instance, run some experiments and gain some firsthand knowledge by testing their own fish.

I have never done any work with hormones on fish, but I've spent many hours in discussion with other hobbyists who have, with varying degrees of enthusiasm and success. The main thing I invariably come out of this type of discussion impressed by, is the fact that fishes and people, anatomically speaking, are still very similar and the same basic facts apply to both. So, I think the best thing to be done for the beginner on this subject is to make sure he understands his own endocrinology.

You are already familiar with the Glands, like the salivary glands of the mouth and the gastric glands of the stomach. They funnel their secretions through a tube, or duct, into a digestive organ, and Nature takes its course. But those who wish to harness the hormone must take on the study of the DUCTLESS glands, which are entirely different from the digestive glands. Their proper name is Endocrine glands, but the name "ductless" indicates the vital fact that they have no ducts leading from them.

The secretions they give off, go right straight pell-mell into the blood stream and using the blood as a transporting medium they reach every part of the body and influence all the organs. The Endocrine glands operate in a state of dynamic balance, which means that the secretion of one gland may influence the activity of other glands. If one gland becomes overactive the balance is upset and the other glands become overactive also.

We think of the ovaries of the female and the testes of the male primarily as organs for the production of eggs and sperms. However there are certain cells of the ovaries and the testes which serve as DUCTLESS glands. These special cells secrete the female hormone ESTROGEN, and the special cells of the testes produce the male hormone ANDROGEN. These are words everyone is familiar with even if the meaning is not clear as yet. As you get over I promise you will be on very intimate terms with Esther and Andy.

TESTOSTERONE, one of the active parts of Androgen, can now be produced artificially and is used in treating sex hormone disturbances in both males and females. Furthermore, the production of THIS hormone is not limited to the testes. It is secreted by the cortex of the adrenal glands in BOTH males and females.

In the female, the ESTROGEN secreted in the ovaries normally neutralizes the effect of the ANDROGEN she receives from her adrenal glands. However, if the estrogen secretion in the ovaries is reduced, the female may become masculinized. Similarly, reduced production of Androgen in the testes of the male can result in feminine tendencies. Thus different individuals may represent various degrees of maleness or femaleness.

Hormones have been used by tropical fish hobbyists, basically, to improve color factors and to gain much larger fish than the norm. Some of the best sources I have known say that the hormones are best used on young fish, as soon as you can sex them. You are supposed to use the female hormones on some selected MALES if you want huge size, and if you want females with tails to rival the males for size and coloration, you are to use testosterone on them. Remember, you don't use male hormones on males, or female on female. Use a little of the ingit which has just been presented here and see why.

My sources always warn that if you OVERDOSE them at this point, most of the fish will be sterile, and chunks of skin and flesh may fall out from cancerous growths caused by the overdose. You must administer the hormones very slowly over a period of time. Don't figure that twice as much will make them twice as big and colorful, and be aware that any effects that YOU give your fish are NOT genetically passed on to their fry.

In conclusion, as my worthy colleague, Bryce Tuller, has often said, "I hope that you haven't learned more than you wanted to know", but instead learned a little you might need to know somewhere, sometime.

In my time of innocence, Mothers simply warned us that a whistling girl and a crowing hen would always come to a very bad end. They couldn't be made to say what the end would be, and some of us are afraid to whistle for years and years. Be my guest and whistle all you want.

Reprinted from the OKLAHOMA O'CLARIST, February, 1974, published by the Oklahoma City Aquarium Society, P.O. Box 1134, Oklahoma City, Oklahoma 73101.

Editor's Note: Some of you may remember from an earlier article of Ginny's that we mentioned that Ginny has lots of guppies. Hormones have been used mainly on fish that have anatomically different males and females, such as guppies. There has been some use of hormones on other fish, such as Discus, to bring out colors that are not normal in either sex, sometimes these are sold as "new" subspecies.

Female hormones are used on male guppies when they are very young in order to increase the size of the mature fish. The female hormones delay the effect of the natural male hormones which cause the color and shape of the male and also slow the growth of the male. Excessive use of the hormone which is added to the water will cause sterility.

Male hormones are used on female guppies when they have matured in order to cause the color and large tails that are usually characteristic of the male. If the hormones are given too early, the growth of the female will be slowed and she may not reach normal size. Sometimes the females are color treated with a mild application of the male hormone to determine what color genes they are carrying. Again, excessive use will cause sterility. Hormones are available only with a prescription as they can be dangerous if misused.



**EDITOR'S NOTE.** If you remember, Malcolm Delingpole described Paul Gorski's tanks as being "devoid of plants or gravel" as were Dale Murteeny's and the Parrott's. If you will also remember that their tanks numbered in the 70's. As your tank numbers increase, you will realize how much easier it is to simply siphon along a clear bottom and clean your filters as needed. I might also add that a number of breeders like to use the Scotchguard Scouring Pad to clean the sides of the tanks. It's made for use with teflon so it does not scratch the glass, but gets through any algae easily.

## AN INTRODUCTION TO HORMONES

*Originally from the November, 1973 issue of the Guppy Gazette, I got it from the May/June, 1977 issue of Livebearers.*

In today's guppy hobby, many hobbyists use hormones of various kinds to aid them in improving and maintaining their strains and/or to win at guppy shows. Most usually, if a hobbyist is using hormones on his guppies, he does so for one or all of the following reasons:

- (1) To color test females
- (2) To increase fertility of females
- (3) To grow large males for show
- (4) To bring out vivid color in females for show

Of these four, the opportunity to color test females which is provided by a knowledge of hormones is probably the most valuable to a serious guppy breeder. The ability to use hormones to overcome infertility in female guppies certainly also has its place in the practice of our hobby. The last two, having to do with the hormoning of show specimens for the sole purpose of winning at guppy shows, if they have any value for the hobby is at the very least debatable. However, an introduction to hormones would not be complete without a mention of these debatable uses -- if only to enable the uninformed to be suspicious of show fish which far exceed the norm in size or color.

**Color testing** is the use of a male hormone to aid in the selection of female breeders. Properly used, this treatment can reveal what color a female will pass on to her offspring, without destroying her fertility. The color gold or bud, which a female will contribute to her sons is often not visible in her because it is suppressed by her own hormones. In addition, color which she does show normally is not necessarily a color that she will pass on to her offspring. All of this makes it very difficult to select female breeders for color, but a female treated with the male hormone testosterone will reveal her "true colors." For some varieties (reds, for instance) selection of female breeders by color testing with hormones is almost a necessity if good pure color is to be maintained generation after generation.

**Increasing female fertility.** In a strain line has developed, its genetic flow can sometimes be accomplished by proper treatment with the hormone.

**Oversized males** on the show bench very frequently did not get that way naturally. They may have been hormoned, and unless this treatment was done carefully they may well be sterile as well as large. Hormoning males to produce extra growth is done by treating them for a short period when they are very young with a female hormone. Under this treatment, a young male thinks he is a female and grows "like a female" until the hormone treatment is discontinued -- thereby attaining a larger body size than he otherwise would. If done well, this kind of hormoning will not affect his fertility.

Brightly colored females on the show bench are especially suspect, because it is usually not in the nature of things for a female guppy to display brilliant color. The hormone treatment used to produce bright color in the caudal and dorsal of the show females is the same as for color testing female breeders, except that dosage is increased and the treatment is continued until bright overall color is achieved. This heavier, prolonged treatment will almost always make the treated female sterile.

There are many hundreds of substances called hormones and more are being discovered all the time. Some guppy breeder somewhere has probably fiddled around with trying hormones in practically any form you ever heard of. We have even been told horror stories about popping the wife's birth control pills in the guppy tanks "to see what would happen." Hormones are potent and potentially dangerous substances. Dangerous for your guppies, dangerous for you, and dangerous for any children in the house -- if they are handled carelessly.

Properly used, hormones can be a great help to the guppy hobby.

## TO BETTER COLOR IN GUPPIES

by Fred Samuelson

### SUBURBAN MARYLAND AQUARIUM SOCIETY PUBLICATION

Breeding guppies for color can be accomplished while increasing or maintaining size and vigor. Careful selection is the key. Always start with good fish from a reliable breeder who maintains set lines. Also remember that optimum living conditions and proper diet are vital to the proper breeding and maintenance of good fish.

I have developed and used the following procedure for many years. It is a concept in breeding, with the flexibility required for color control. It allows for new blood to be added and aids in maintaining good vigor. Genetics, heredity, reproduction and control by selection are the basic factors. True, there are many possible re-combinations. However, this method does work. I have some strains that have been worked in this manner for ten years and more.

Before any cross breeding of fish can be started, the color lines of the guppies must be established. To establish color lines, it is best to line breed, for inbreeding can result in hybrids. If the fish to which you cross also happens to be inbred. Blue strains and red strains should generally be line bred for three generations to establish color, while green strains require but two generations of breeding green to green for color stabilization. However, some variations in body color may still be expected when crossing.

The base color line I use is red. After breeding the line in the color red for three generations, the first cross is made. This cross should be made to a blue line, using good male from a line that shows the average male to be of good-size and vigor.

If the first cross is successful and the progeny are of good size and are vigorous, you have successfully started the color breeding. Make a note of the lines used, both blue and red, and keep this for reference in future crossing. I use the following system to denote lines in my records:

#### CROSS

Blue male cross red female  
Blue Red spawn back to blue  
Blue red spawn back to red  
Blue red blue second breed to blue  
Blue red blue second breed to green

#### SPAWN

BR males	BRB males
FRH males	BRHB males
BRBC males	BR Females
BRB females	BRR females
BRBB females	BRBG females

Thus, you are aware of the line's background across three or more generations. Also, numbers can denote color lines, as B or 3 for separate blue lines. Therefore, the progeny of a cross between red and three and blue line one would be R3B. This type of notation is also ideal for work with friends if you do not have sufficient tanks to maintain several lines.

The females of your first successful cross of red to blue may be crossed to either another blue line or back to a red line. Crossing to a blue line produces lighter blues, while crossing back to red produces brighter reds. If the females are crossed with blue males, the lighter blue females resulting from the cross should be used for crossing with green males. This will help produce a lighter and brighter green line. Also, green females resulting from this cross can be used to cross back to the red line to deepen the red color. Remember to preserve virgin females from each cross for use if mutation occurs or for use in further crossing.

When breeding is performed properly, the same variety and strain should be consistently good. A good breeder maintains his fish under optimum conditions throughout the year.

#### The Basic Maintenance Rules I Suggest Are:

1. Change ten percent of the water weekly, adding an additional amount to cover evaporation loss.
2. Feed often and in small amounts, never overfeeding. Three to five feedings daily should be sufficient. The diet should consist of highly nutritious food rich in protein. Microworms may be fed two times weekly. Naturally, the staple foods of our diets are Renuil Foods (for results).
3. Tank population should not exceed one and one half inches of fish per gallon.
4. Keep aquarium clean.
5. Plants, if used, should be of soft leaved varieties.
6. Clean filters weekly, washing the charcoal and replacing the glass wool.

This article has considered three of the four keys to breeding and control—the breeding concept, environmental conditions and diet. The fourth condition we assume. This is the diligence of the breeder.

## SELECTION OF AQUARIUMS

by Elvis Bryant

*Reprinted from THE DARTER, Oct., 1974 Missouri Aquarium Society*

Size of aquariums is important, from the standpoint of number of guppies. No guppy will grow if his environment is wrong. A young guppy needs growing room if he is to mature to his greatest size.

Five gallon aquariums are excellent for raising fry of 1 week to 1 month. In this small area the fry will find food supplied by you. This is important for if the aquarium is too large, then the fry must look for their food.

Small 5 gallon aquariums can be cared for easily. In bare bottom aquarium you can see unclean ponds. Be sure to syphon daily if necessary to be sure these fry are constantly in an environment that promotes growth. Then when the time has come be ready to remove these fry to larger aquariums.

A ten gallon aquarium is another excellent guppy aquarium. These are basically what I use in my guppy room. I use these for fry 2 months to 3 months old, keeping them not to overcrowd.

Breeders also like the area of a ten gallon aquarium. It gives your guppies a chance to move about more freely. Nicely planted, this aquarium can be set up for months before becoming heavily clouded, or algae becomes a problem.

Fifteen gallon aquariums are excellent for guppies 4 to 7 months old. The available surface area which guppies need to extend their caudal fin very little pressure on bodies. These aquariums are easily overcrowded, recommended numbers of guppies, 20 no more than 30 is good, 40 is better no way. Lesser amounts will work even better than large aquariums.

Twenty gallon high. This aquarium I believe is the best aquarium for raising young from 2 months old to 4 to 5 months old. The 18 inch height of these aquariums has led me to believe that is what put body size on all my guppies. People often remark about my body size on my males, well there the secret here is one.

Being 18 inches high the pressure per square inch is great. So when your guppies swim in these environment they are actually battling against that pressure, so they develop larger chests and larger tails.

Twenty gallon long. Like a fifteen gallon aquarium offers the big surface area for guppies to develop those large caudals that everyone loves to see.

These five basic sizes of aquariums are basically what you need. Larger aquariums are not as beneficially baited as you might think. Greater densities of these aquariums do wonderful well for body development but some times the caudal fin will not grow into the same ratio of the body.

Therefore you have large bodied guppies, but no tail and if you don't remove these at the right time, you will never develop the caudal fin.

## SECRETS YOUR GUPPYS DON'T TELL YOU

### Part III

by Midge Hill, GR, May/June, 1971

#### THE SENSES

Guppies have all five senses...sight, hearing, smell, taste, touch...and one more 'sixth' sense which is unique in fish. The main organ of perception is the brain, which is the enlarged terminal of the Main nerve cord, which runs through the vertebral column along the upper part of the body. Impulses from the sense cells are carried to this central station.

#### How A Guppy Sees...

Sight in guppies functions much as it does in humans, except that the problem of water refraction must be coped with if the fish tries to look at anything above the surface of the water. The light rays bend as they pass through the water surface so that when focusing on an insect above the surface, a fish must adjust well ahead of the target it seeks. As the guppy usually focuses in the water, it does not have much problem with light refraction as light travels in a straight line under water just as it does in the air. A more important factor to the guppy is the blurring vision caused by the fact that even the clearest of water is much less clear than air and closed-system aquariums are not always even the clearest of water!

Since the light is usually not bright under water, the eye structure of most fish has been simplified so that they get along with little or no contraction of the iris. The iris, the metal-looking ring around the dark pupil, does not widen or shrink to regulate the amount of light passing into the eye. The iris is virtually inflexible. We wonder why the guppy will seek a dark corner when a bright light or flood light is shone in his direction. His eyes cannot make enough adjustment to cope with it.

Being constantly bathed with the surrounding water, the eye of the guppy has no use for either eyelids or tear ducts to wash the eye and keep it free of foreign matter. The eye is merely covered by a transparent, unpigmented, layer of skin, which freely passes its light through. Which all adds up to the fact that the guppy has no way to close its eyes.

Since guppies must need to see objects at only fairly close range, their eyes are built with lenses that are more spherical and rigid than our eyes. His eyes are set to see objects in the immediate foreground, but if it should need to look further, the crystalline lens can be pushed backward in the eye by a special muscle. But even at best, the guppy probably can never focus well. To prevent the problems of light refraction as light rays enter the watery substance inside the lens from the surrounding water, the lens must be sharply curved to focus an image on the retina. The sharpest curve attainable is the sphere—hence the spherical lens of the fish eye. Even this may not be enough to give it a really well-focused picture. (See figure 1.)

However, guppies do have an advantage over us with their monocular vision; they can see in more than one direction at a time and thus see more of the world around them at one glance than we can. With an eye on each side of its head, a guppy can focus on both sides of its field of vision at the same time. This

makes it difficult to judge distances, but, probably there is a relatively narrow area straight ahead which allows both eyes to see simultaneously, giving the fish a limited measure of binocular vision and hence some sense of perspective. When a guppy whirls around in response to something that attracts its attention on one side, he is probably bringing the object into the narrow common field of vision of both eyes, where its distance can be better estimated.

FIGURE 1:

Schematic fish eye  
S=skin + head  
V=vertebrae body  
L=lens (by Alex Bartsch as  
printed in "Anchor", SFAS)



FIGURE 2:

Monocular Vision. Eyes focus on both sides of the field of vision at the same time. Shows the limited area of binocular vision where the two fields overlap.

#### Can a Guppy See Color?

Guppies show evidence of seeing color. The nerve cells in their eyes are supplied with visual cones (the cells that differentiate between colors) and visual rods (which are mainly used at night). To what extent guppies make use of color in their daily existence is, however, still a mystery. Some show preference for one color over another and many have been trained, in experiments, to respond to specific colors in specified behavioural patterns. If a spectrum is shone into a darkened aquarium, fish will normally go for the green and yellow bands and remain in them. If only a red light is used, they behave as if they were in the dark. Guppies come in such brilliant contrasting colors and patterns that it would seem the color must have some significance. However, as a general rule, guppies are not color selective...they do not seem to identify with other similarly colored guppies, nor do they shy away from those wearing a different color. (As any breeder knows when a blue male gets into a tank of his prime show males!)

It is probably that, like goldfish, guppies have trichromatic vision, meaning they can distinguish a wide variety of colors regardless of variations of their brightness. Experiments also indicate that fish cannot be trained to differentiate colors by a decrease in light. In fact, in this respect, their color discrimination far exceeds that of humans. The ability to discriminate color even in very dim light is no doubt a result of necessity as many underwater habitats vary in light and depth. Moreover, if a fish has been trained to go to a specific color, they will continue to choose that exact shade over any other shade or depth of the same color, or even over the same color created by shining a colored light on a gray surface (his foolish people every time.) In fish the main confusion has resulted in overlooking differences between reds and ye llows.

#### How the Guppy Hears

Much study has been devoted to whether guppies hear in our sense of the word. Probably they cannot. Their ear, which is composed of two closed cavities on opposite sides of the head, seems to be purely a balancing organ. However, using underwater microphones and tapping devices, it has been found that fish do make noises under water...sound waves have been recorded for apparently intentional sounds made for some specific purpose. Short bursts of sound have been recorded in response to territorial threat, as breeding signals and as recognition signals. It therefore seems logical to suggest that such sounds must be perceived by fish in some way. The likeliest explanation seems to be that, using the swim bladder as a resonator, they can sense sound waves.

## Does A Guppy Feel Pain?

There seems to be no very satisfactory way to learn from a fish just what it feels. Is the way of physical pain. Pain is an experience of the brain responding to information conveyed to it by the various nerves, but guppies have no brain structure similar to the cortex, which in humans produces pain, and there is no other part of their brain which appears to perform this function. Their most common reaction to excessive stimulation is merely to seek escape. The lower we go on the evolutionary scale, (and the fish are comparatively pretty low) the higher the pain threshold - the amount of sensory stimulation required to produce pain becomes. For this reason, there is considerable doubt that a fish can feel much in the way of actual physical pain. (At least that is what the scientists think. I wonder if our guppies will agree?)

## Learning Ability

The guppy, like many other fish, has an extremely rapid learning ability and quite a reliable memory. Although it is not easy for a fish to learn something that runs contrary to its instinct, fish can very easily learn something that produces a "reward" desirable to fish.

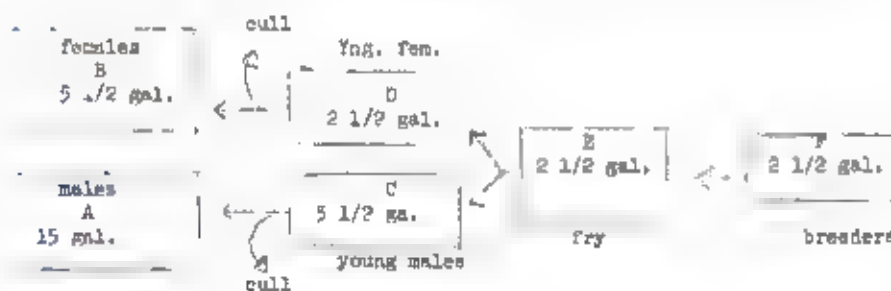
Coldfish have learned to treat themselves to a cool square of water whenever they felt uncomfortably warm, by pressing a lever, a cockle burr caused to swim through a small ring for the opportunity to glide and court a pump female. Many kinds of fish, including guppies, have learned a wide variety of "tricks" for valuable rewards, even to threading intricate mazes. Even more remarkable is that the fish remember what they have learned, and within a few days can perform with very few errors.

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## MAINTAINING A STRAIN OF GUPPIES

By Gerry Serra - Reprinted from THE BULLETIN, 12/73 Montreal Aquarium Society



The schema above is a description of the system to use to keep a single strain of guppies. As you can see, you need three 2 1/2 gallon tanks, two 5 1/2 gallon tanks and one 15 gallon tank. Throughout this article, you will have to refer to this schema (which is self-explanatory) to fully understand the cycle to use to keep a strain of guppies.

To start with, you have to decide what type of guppies you want to keep. One word of warning, do

not jump on the first strain that you see! When your choice is made, I would suggest that you get 2 males and three females to lessen the chances of sterility. It is much better for you to get your breeders from a person that you know to be raising guppies. The reason for this is quite simple. The imported guppies are more than often mixed up in strains, that is, you are just about every time buying females but are in no way related to the males.

So find a guppy breeder around your area so that you are sure to start the right way by obtaining the right males with the right females. If you don't know any, just ask around at your monthly meetings.

Now that you have your breeders, you put them in **tank F** with a good cover of water sprigs or better yet, provide the tank under the light with a few plants like Nitella. Assuming that everything goes well, the first batch of babies should come out about 30 days after you purchased your breeders. (I forgot to say before to make sure to buy virgin females, so now I've said it). You will see that the babies will tend to stay in the Nitella under the light.

Now you must remove your babies and put them in **tank E**. I personally prefer to move the babies and leave the parents undisturbed. Feeding the fry is done five times a day. Here is what I suggest: at 8:00 a.m. newly hatched brine shrimp, at noon dry powdered food, at supper time micro worms, at 8:00 p.m. dry powdered food and at 11:00 p.m. newly hatched brine shrimp. Of course, I say it is easy to keep this schedule, but I am speaking for myself and beside this is only a general idea. It is up to you to find out when you can feed, and what you can feed.

After 3 to 4 weeks, it is time to separate the sexes. The females can be located by their gravid spots and they are moved to **tank D**. The young males are moved right away to **tank C**. This leaves **tank F** empty and ready for the next batch of young that will soon come.

The females that are now in **tank D** and the males that are in **tank C** are now ready to eat coarser food with high protein. You can feed them as follows: 8:00 a.m. newly hatched brine shrimp, the 3 next meals are given at the same time as with the babies, except that the food is different. Here are some of the food you can give them: Beef heart, liver paste, earthworms, live tubifex, white worms, high protein dry food (it is best if you have six or seven different types of dry food averaging 70% protein), flakes, blood worms, daphnia etc. The last feeding is newly hatched brine shrimp.

After about 2 to 2 1/2 months it is the time to select which males will go in **tank A** and which females will go in **tank B** for further growing. You have to keep in mind that the third bunch of fry are coming and this is if they're not already there in **tank E**. Select the females that seem to be more vigorous and bigger than the others and put them in **tank B**. As for the males, take 2 or 3 and put them in your community tank to be put at maximum size. This community tank can be around 20 gallon capacity or larger. If you have one. The remaining females may be discarded or kept as you wish but remember that you have more coming from **tank E**. For the males, select the ones with larger bodies, more colors and that promise to develop a very wide tail and put them in **tank A**. Do not overcrowd this tank under any circumstances. I would suggest putting around 20 males in this tank but no more. One thing has to be mentioned here, too: all strains of guppies begin to develop a caudal fin at around 2 1/2 months of age, so in this case you will have to judge by general appearance which males promise to be better. As the other generations of males are coming on, if you took a wrong guess on a male, take him out of there and put another one in which promises to be better. As with the females, discard your surplus males if you wish. Never overcrowd your tanks as you will have stunted fish.

Well as you can see, if you read carefully this article, we started with the breeders in **tank F** and we ended up with matured fish in **tank A** & **B** plus a few females to grow up for the show in the community tank. A cycle has been established and when your breeders will die, (if they didn't yet) you have mature fish in **tank A** and in **tank B** to restart the cycle again.

## WHAT COLOR ARE YOUR FISH?? ARE YOU SURE??

Many hobbyists have at times wondered about the rapid changes in color that their fish exhibit. Some go through so many color variations that arguments have arisen as to the accuracy of color prints shown in all the more popular aquarium related literature.

Let's see what causes this color variation according to the experts. Obviously fish, as well as birds and insects, are highly colorful. Therefore they must be equipped with similar eyesight as the human visual sense or else they would see only chromatic shades of gray, black, brown, and white.

**Basically, the color is due to the following:** In the dermis (outer layer of skin) of the fish we find large cells that contain chromatophores. They are in the form of granules or droplets that can distend or contract instantly, thereby intensifying or decreasing the color.

The basic granules are called melanins. These are in black, blue-black, or brownish black. The droplets are called leucophores that are red or yellow.

Strange as it may seem, there are absolutely no green nor blue pigments. At this point, I realize the thoughts that have entered your mind. You have seen these colors in a large number of fish. I hope I can explain this phenomena to you so you can understand.

Fish have shiny crystals imbedded in the second layer of the dermis. They shine through the upper layer of dermis. If the fish tends to be fat, these crystals look yellow. The more fat the deeper yellow it becomes. When the black granules in the chromatophores are viewed with the yellow glow behind them they look blue or green. At this point I want to stress to you that the fishes basic colors must not be confused with the delicate hues resulting from the reflective metallic luster of the fish. (Those of you who have used highly fluorescent colored gravel have perhaps noticed the reflected color on your fish, for example, vivid red gravel used with silver angels.)

These gummy (crystals) also will work under certain types of light. In a basic incandescent light the colors you see are actually truer of the fish for the chromatophores are more evident and the reflective gummy less.

When the crystals are imbedded deeper in the dermis of a fish they form a silver layer called argenteum so common in your truly all silver fish (silver dollars, tin snail barbs, etc.). If the chromatophores are equally intense we experience the marvelous effort of luminosity seen in fish like the neon tetra.

The color cells of fish are primarily the result of light. You will notice the behavior of fish tend to be less colorful and fish deprived of light have a relatively pigmentless skin. Cave fish. Fish also adapt to the surroundings of their native habitat in color and design.

The fish can change color by contracting or distending the pigments in the chromatophores such as turning pale when in discomfort or deepening the color when excited. These changes can be as rapid as a few seconds over either part or the whole body.

Experts have noted definite color changes due to lowered temperature, fright, lack of oxygen, diseases, discomfort of all types, change of diet, and excitement.

Spots, stripes, bands, etc. are primarily acquired due to surroundings, but also coloring plays its part in the same way. This is used by a large number of fish as a protective device, a camouflage, to enable them to more easily blend in with the area they live and to keep them safe from natural enemies.

The fish can darken in dark surroundings and pale in lighter ones. A number of fish have a permanent mating color such as the rosy barb, whereas others go through a variety of changes during the stages of spawning. You can easily see this with most dwarf cichlids.

They have separate colorings for fright, fighting, mating, spawning, and breeding. As a rule in fish, the male is far the more colorful. Some fish even have a resting color as you can discover by turning on a light after the fish have been in darkness for a while. The blue moonfish take on a purple cast.

Some colorations help you to spot the areas where the fish are found. Open water fish have a light silver glister. Bottom dwellers, tend to be spotted. Plant dwellers have cross stripes and close to shore fish have dark clouded designs.

Those of you have done any skin diving or scuba have perhaps noticed that when you are viewing fish underwater that you often see them in shades of grey similar to black and white photography, and certainly nowhere near the vivid colorations seen in a well lit tank.

This has led to controversy as to the ability of fish to actually see color. Extensive experiments have definitely proven that they do see color. If your fish is colorful, you stand a better chance of having a healthy fish. If a fish varies from its natural coloration whether in normal or spawning colors, it is a malformation.

The changes occur due to absence or overabundance of certain pigments, internal disease, lesions, eye defects, and other un-diagnosed injuries may produce black pigment, this is called melanism. Other colorations are xanthism (gold coloring), a himism (lack of color) and albinism (ability to produce the glister and sheen common in healthy fish). If your fish suddenly develops these symptoms, hereditary formation is apparent, yet may not lead to fatalities. An exception to the rule is found in goldfish that have a variety of color changes over a period of time.

If your fish are well cared for their metabolism will be in balance and you will experience the great pleasure of seeing a variety similar to a veritable rainbow of color in your tanks.

by H.J. Barker

reprinted from Aquarium World, Brooklyn Aquarium Society June, 76



## "ROOM FOR IMPROVEMENT"

The same is true in tropical fish in general and also in our special fish - the guppy! The basic differences between the ribbon, the veil, the delta and the wide-tail are "genetic" in origin and can be observed and demonstrated easily with the aid of a high power jeweler's or taxidermist's lens and a properly prepared and mounted specimen.

The following are my personal observations and many fish had to be sacrificed to get at the basic truth.

The average guppy has a caudal fin composed of 25 rays at the base, a few were observed possessing only 23 and others with 27 but on average 25 seemed normal. The number of basic rays in the dorsal is 6 but in the majority of fish only 5 developed to full length. It was observed that the basic caudal rays divide as they grow. Some divide only once between the base and the caudal fringe, hence 25 rays at the base become 50 at the fringe, your typical ribbon tail. In the case of the veil 2 or 3 divisions may occur, thus 25 at the base become between 100 and 200 at the fringe. It was noted the first division is about 1/8" to 3/8" from the base, the second division 3/16" further along, the third division a further 1/4" out towards the fringe. What is true of the veil is also true of the delta, no y now we observe 4 divisions, each basic ray divides 4 times thus, ray becomes 2, then 4, then 8, then 16 at the fringe. This is not the end of the story, now comes the widetail, believe it or not, this guy in maturity has no fewer than 5 divisions. Each primary ray has become 32 at the fringe. Wow, you say, What comes next? Who knows? Only time and further improvement will show us if 6 or 7 divisions are possible. Now we must state other observations. The first 3 rays on both top and bottom of the caudal do not divide and only grow and develop at maturity. Their purpose seems to be a stiffener for the caudal leading edges to cut through the water as the fish swims. The next 3 or 4 rays do not divide as much or we would end up with a guppy having a near semi-circular caudal. From my observations, it would seem that most of the divisions occur in the 16 to 18 rays comprising the centre of the caudal.

Now in the case of dorsals, the lesser developed leading ray also acts as a stiffener, the major dividing occurs in the 5 trailing rays. The divisions are much closer spaced than those of the caudal and occur closer to the body of the fish. Giving the narrow lozogram shape of veils and deltas, however, in the widetail the overall shape is either wedge shaped or in extreme examples a ballooning shape.

The next difference noted was the shape and curvature of the caudal/body junction area. Some are almost flat, some are semi-circular and some are parabolic in appearance. The centre ray of the fin is always coincident with the centre row of body scales. The spacing of the rays from this central ray is maximum in the tail centre gradually decreasing towards upper or lower extremities. This factor is very evident in the widetail, less in the delta, even less in the veil and barely noticeable in the ribbon. The widest spacing is in the 8-20 rays forming the centre section of the caudal.

Now there have been articles galore written on the care and keeping of guppies, e.g. food, light, water conditions, etc. It is my contention that all the good feeding and excellent environmental conditions in the world will not change a veil into a delta or a delta into a widetail. The types of fish we have today are the result of selective breeding and the improvements observed are "genetic" in origin. There are two very distinctive features that go along with the widetail configuration. First, due to the semi-circular shape of the caudal/body junction plus the wider spacing of the primary rays, plus the greater amount of ray division, the end product is a caudal at least 90 degrees wide (I have specimens nearly 140 degrees wide). The fringe will be convex or scallop shaped since all rays tend to grow to the same length. Second, the dorsal fin will be wedge shaped and much wider than typical delta standards. Lengths of both dorsals and caudal, of course, still ask now depend on the maturity or age of the fish.

## REPORT ON BREEDING TECHNIQUES OF THE GUPPY PART 7 - HALF BLACK BLUES

Compiled by Maumee Valley Guppy Association  
(Not for reprint without permission of IFGA or MVGA)

We have contacted the top breeders of each color class and have compiled the following report. It is hoped that this information will be useful to all guppy breeders and especially to the novice to help him in the right direction. This and the following reports should give an insight on how the top breeders approach the breeding of their guppies. The way we can encourage new breeders is to give them a helping hand and to give them the advantage of our mistakes. For this issue we will report on the Half Black Blues. If there is anything that you can add as fellow breeders please send it in. This report can always be added to. We wish to thank the following for their help with this report.

John Mackey - Michigan Guppy Breeders • Warren Burke - Big Apple Guppy Group  
Ron Yater - Zionville, Indiana • Doris and Mike Lastella - East Coast Guppy Association

### QUESTION 1. HALF BLACK BLUES STRAINS REPRESENTED AND THEIR SOURCE.

1. John Mackey - Kvetar 3/4 black male crossed to Shubel purple female. Inbred for 3 generations then crossed males to Shubel blue female and South blue females to obtain three different lines.
2. Warren Burke - H/B Blue hybrids. They breed true after 3rd generation.
3. Ron Yater - Developed by crossing H/B AOC male to blue female in 1970. Worked 3 lines from this.
4. Doris and Mike Lastella - Developed their own strain.

\*\*\*\* All four breeders have developed their own strain.

### FEATURES OF THE STRAIN AS COMPARED TO AVERAGE.

Strains	1	2	3	4
Size	Aver.	Aver.	Aver.	Aver.
Tail Width	Aver.	60%	Larger	Aver.
Dorsal	Aver.	Large	Larger	Large
Rate of Growth	Slower	2 mos.	Aver.	Slow
Rate Maturity	Slower	Early	Aver.	Aver.
Fertility	Good	Fair	Aver.	Less
Cannibalism	Less	Less	Aver.	Less
Susceptibility to Disease	Less	None	Less	Less

### BREEDING TRIALS

Strain	1	2	3	4
Time Kept Pure	2 yrs.	2 yrs.	13 yrs.	9 yrs.
Spacing		50/50	Uniform	
% Desired Color	30%	75%	75%	99%
% With Impurities	30%	40%	20%	20%
% Different Color	40% *	10%	5% *	1%

\*1 % Different color comes out a nice H/B Purple. The three lines I have are all 3 different shades of blue.

\*3 Black spots in caudal in some drops.

\*\*\*\* Breeders 3 and 4 who have had their lines for many years have a higher percent of desired color than breeders 2 and 1 who have only been working on their lines for 2 years.

# BREEDING TO MAINTAIN THE COLOR

Strain	1	2	3	4
Inbreeding:				
Sib-ing Cross	Yes	Yes	Yes	Yes
Father to Daughter	Yes	No	Rarely	No
Mother to Son	+	No	Rarely	No
Line Breeding:				
No. of lines	3	2	3	2
Crossed after No. Gener	4-6	3	3-4	6-8

\*\*\*\* All breeders use inbreeding of sib-ing cross

# EFFECTS OF COLORATION OF CHEMICALS, TRACE ELEMENTS, FOODS, ETC.,

Strain	1	2	3	4
Food	None	Variety	None	Slight
Chemicals	None	None	None	
Trace Elements	None	Salt	None	Not noticed
		7-8		Darken with lower pH

# BREEDING FROM FISH FROM THIS STRAIN

Strain	1	2	3	4
Same method as for maintaining this strain	Yes	Yes	Yes	Yes
Controlled hybrids		Yes	Sometimes	On occasion
Pure strains?		75%	Yes	Yes
Always the same two strains		No *	No	Yes

\*2. Crossed to pastels

# OUTCROSSING - THE EFFECTS ON COLOR

Strain	1	2	3	4
Blue	*	*	Good	Will enhance color
Green	*	No		
Red	*	No		
Multi	*	No		
Snake skin	*	No		
Other	*	H/B Pastel		

\*1. I out crossed to produce Half Black Blue strain which is inbred and the breed

I have not crossed pure Half Black Blue since producing the three lines

\*2. Only on Half Black body in pastels

\*\*\*\* The only outcrosses seem to be to the Blue and Half Black Pastels

Question 8: If all of the strains were lost except one lone male - what would you consider to be the best outcross to make to preserve the color?

1. Blue female
2. A hybrid Half Black Blue delta 60% and Half Black Pastels delta 60%
3. First another Half Black Blue female from another breeder that has my strain. Second choice Blue female
4. Must go to related color Half Black Blue to Blue.

# Question 9: Goals Pick ng breeders and fry expectations.

1. To increase size and have the dorsal and cauda as close a match as possible
3. One line I strive for is a cornflower blue dorsal and cauda. The other ones a dark blue dorsal and cauda.
4. To breed as close to the standards as possible

# SELECTING BREEDERS - MALES

Strain	1	2	3	4
C/R Ratio		*	3rd	
Body size	Yes	*	3rd	Aver.
Body shape	Yes	Firm	3rd	Heavy peduncle
Body color	Yes	Intense	2nd	Best
Caudal size	Yes	Large	2nd	In proportion
Caudal shape	Yes	60%	2nd	60%
Caudal color	Yes	Solid	1st	Clean & pure
Dorsal size	Yes	Nice	3rd	Large
Dorsal shape	Yes	Fine	2nd	3 to 1
Dorsal color	Yes	Pure	1st	Match to caudal
Other		Size	*	*

\*2. The C/R ratio should have good balance and color. In the body size there also should be a nice caudal and dorsal

\*3. You should look at color first and then size on everything else

\*4. You usually don't pick the largest or best color in the tank but the best overall fish

# SELECTING BREEDERS - FEMALES

Strain	1	2	3	4
C/R Ratio		2-1	1st	
Body size		Medium	3rd	Stocky
Body shape	Yes	Good	3rd	Heavy peduncle
Body color		Black	3rd	
Caudal size	Yes	Large	4th	
Caudal shape	Yes	Delta	4th	
Caudal color		Dark	2nd	
Dorsal size	Yes	Good	4th	Large
Dorsal shape	Yes	Good	4th	
Dorsal color		Solid	3rd	Most color possible
Other		Active	*	

\*3. Look for Blue caudal not green with no spots.

# BREEDING AGE, SIZE OF LITTERS, RATIO OF MALES TO FEMALES

Strain	1	2	3	4
Age bred M	4-5 mon.	3-4 mon.	3-4 mon.	3-4 mon.
Age bred F	4-5 mon.	3 mon.	3-4 mon.	3 mon.
Aver. litter size	30/40	30/60	30/50	25
Ratio M/F	50/50	50/50	Even	50/50

\*\*\*\* All the breeders agree here on age and size of litters.

# GENETIC TRAITS BELIEVED CARRIED BY THE DIFFERENT SEXES

Strain	1	2	3	4
Body size	B	B	B	M
Body shape	M	B	B	M
Dorsal size	M	B	B	B
Dorsal shape	M	B	B	B
Dorsal color	M	B	B	M
Caudal size	B	B	B	F
Caudal width	B	B	B	F
Caudal color	M	B	B	M

\*\*\*\* Breeders 1 and 3 believe that both male and female play an important part

## Question 13: Special problems with this strain

- Getting a good dorsal and caudal color match
- None
- None

## FAVORED ENVIRONMENTS FOR KEEPING THIS STRAIN

Strain	1	2	3	4
Salt	Some	*	Some	*
Special diet	No	*	None	*
Spec. environment	No	No	No	6.8 pH
Tank size	5/10/15	5/10/15	*	*

- I use one teaspoon of salt per gallon. As a special diet I use brine shrimp, paste foods, microwaved green vegetables
- I use 10, 15/20/30 gallon tanks that are not over 4" tall
- I use salt as needed and only I use 15 gallon tanks for my show males with 8 to 10 fish per tank

## COMMENTS:

- Once I establish size and color, I would like to try and get the head and shoulders a shade of blue
- I always check for intense color when they are young
- The Half Black Blue strains seem to respond to breeding techniques much quicker than other color lines

\*\*\*\* This color strain does not seem to present some of the problems that other strains do. Note that each breeder per se has his own strain without too much difficulty. They seem to breed true

**Editor's Note:** The \*\*\*\* are conclusions of Maumee Valley Guppy Association

## SPECIAL FEATURE

### Some Thoughts on

# GROWTH

by Norman Blumenthal

A quick glance at the current standards of the International Fancy Guppy Association will explain the preoccupation of the serious guppy breeder with growth. Of the possible 100 points that may be awarded to a single male, 34 points may be awarded on the basis of size as opposed to only 28 points for color, 28 for shape (and conformation), 5 for symmetry and 5 for deportment. It is not surprising that the winners in current major guppy shows equal or exceed 3" in length and possess strong, well-developed bodies.

There are a number of factors which have a bearing on growth. Apart from the obvious factors of nutrition and genetics, there are the additional factors of lighting, temperature, biotic factors and social factors.

Shortly after I commenced raising Guppies, I observed a particularly promising male of about 3 months I selected this superior male for breeding and established him in a 10-gallon aquarium with two females. To my surprise these three fish ate very poorly and the growth rate greatly diminished in comparison with their brothers and sisters. While I know of no practical way to measure it, I would venture that these three selected fish consumed less than half as much food per cup as was done left in comparative overcrowded conditions. Soon seemingly inferior males living in crowded conditions surpassed my selected male in overall size. Of course, this same observation has been made by most every guppy breeder.

While I know of no such controlled experiment with guppies, it is worth mentioning some results of experiments made with trout fry. Different numbers of trout fry were placed in identical size tanks and reared in groups of 25, 50, 80, 100 and 150 individuals, with each group given an overabundance of food. The most successful group was the one that contained 80 fish. While we are all familiar with the growth-stunting effect from severe overcrowding, it should be equally obvious that there is a social phenomenon which inhibits growth when numbers are severely limited.

The most knowledgeable breeder I know refers to this phenomenon as the "hungry chicken" theory. He relates that if a group of chickens are fed all that they will eat and then a hungry chicken is placed in the group, the remainder of chickens will again commence eating as though they were half starved. It would appear that with guppies and chickens it is simply a matter of competition for the food. The problem is to determine the most advantageous number of fish in an aquarium at a given stage of development. A highly successful breeder raises fry (up to 40 in number) in 2-gallon containers until they are 3 to 4 weeks of age, at which time they are transferred to a 10-gallon tank where they remain until almost 3 months of age. They are then transferred to a 20-gallon tank where culling is commenced with the ultimate population between 25 to 35 fish.

While the procedure is somewhat varied from breeder to breeder, the basic concept is the same. It would be impossible to reduce the technique to a set formula, and the most advantageous number of guppies at a given stage of development can only be determined by the art of the breeder. Anyone that attempts to raise 20 fry in a 25-gallon aquarium with the hope that they will have that great tank for exercise and growing room is in for an unhappy surprise. I know, I've tried it!

While the guppy breeder has a preoccupation with size, the male guppy also has a preoccupation, sex. I do not know whether it is vain to include this subject in a discussion of the social aspects of the guppy, but I do know that if you desire the maximum development of your males, you must raise them under segregated conditions. Aside from the fact that your males will devote more attention to eating, their activity

rate is substantially reduced and the amount of food necessary for maintenance is less. It is significant that the gonads of the yellow perch before spawning make up more than 20% of the body weight of the female, and more than 8% of the body weight of the male. After spawning, the ovaries or testes shrink to about 1% or less of the body weight. Obviously, large amounts of nutrient materials go into egg and sperm formation, and under segregated conditions you can achieve larger (but not necessarily happier) males.

## WHAT IS GROWTH?

Since our overall subject is growth, it would be valuable to define that term. Growth in animals has been defined as the addition of structural or fleshy elements, or increase of mass. It is apparent that growth necessarily entails the ingestion and utilization of nutrition. Accordingly, our field of inquiry in the present series will be those factors which act as a stimulus to induce the ingestion of food. At a later time we will consider the factors of quantitative nutrition, genetics and the effect of hormones as growth factors.

With the above in mind, there are two basic categories of stimuli that induce feeding. First, there are the factors that are perceived by the senses—like sight, smell and taste—that control the momentary feeding act. Second, there are factors affecting internal motivation or drive for feeding—such as light intensity, temperature, time and nature of the day, feeding, the season, time of day, and any internal rhythm that may exist. Some of these factors are more evident among fishes in their natural environment, and may have little effect in the controlled environment of your aquarium.



## STIMULI TO FEEDING

We have already dealt with one aspect of visual stimulation, the sight of other fishes feeding. Other factors that act as a stimulus to feeding and are perceived by the senses would include the shape, size, color, taste, texture and odor of the foods. I will attempt to relate these factors to some of the observations that I have made concerning guppies.

Among the live foods, the all-time favorite of guppies of all sizes is newly hatched brine shrimp. While I could not authoritatively differentiate between the difference in the flavor of baby brine and the matured brine shrimp, I can tell you this: irrespective of the size of the guppy, the baby brine will be accepted with far greater enthusiasm. I suspect that the preference is based upon the size factor. It should be kept in mind that because of the very small diameter of the guppy's eye, food which seems very small to you appears quite large to the guppy. Apparently the guppy finds the size of the newly hatched baby brine shrimp ideal. And by the way, I am advised that except for the additional calcium making up the skeletal structure of the adult brine shrimp, there is as much nutritional value in a single baby brine shrimp as in a single adult brine shrimp. So there remains a possibility that the preference to the baby brine shrimp may well be based on it. Another factor of "more bouce to the ounce."

Among adult and mature guppies, the only food that I know of that is eaten as greedily as baby brine shrimp is beef heart which has been prepared in a blender. I don't know if you feed beef heart, but if you don't, you should. But if you want to see some really dramatic feeding activity, try introducing the beef heart under direct lighting. The beef heart takes on a bright red color which seems to additionally stimulate the visual senses and appetite, with the result of really frenzied feeding. I digress to give you a word of warning about the preparation of beef heart. All of the fat and sinew must be scrupulously eliminated. Unlike mammals, the guppy produces no body temperature independent of the temperature of your aquarium, and the fat and sinew must be broken down by the digestive juices of that little fish operating at a comparatively cool temperature. Since parts of the digestive system of the guppy are no larger around than a human hair, fats and sinew may cause blockage of the intestine with resulting death.

## THE EFFECT OF ODOR

While I speculate that, like nocturnal feeders, the guppy relies more on his sense of sight than of smell, it is apparent to me that the odor of some foods seems to attract the guppy. George McCrosky of Ohio has been experimenting with artificial flavorings of fish foods for an extended period of time. He has found that while some ground foods of excellent nutritive value are poorly accepted by the guppy in their original state, that by the addition of oil of anise and cod liver oil, these foods are readily accepted. I have tried this on my home compounded dry foods, and it would appear that he is correct.

## LOCATION AND SIZE OF FOOD

It is no secret that guppies are top-feeders, and much prefer floating foods to those that sink to the bottom, although both will be eaten. The reason for the preference may be that the floating food is more visibly outlined against the light, or the preference may be simply an anatomical matter of the guppy's mouth being located near the top of his head. At any rate, I feel that the floating characteristics of flake foods (along with their finer texture), accounts for the guppy's preference for flake foods over dry ground foods. This floating characteristic is accounted for by the extreme fineness of the flake together with the amount of air pockets in the food. This observation relative to the preference for flake foods grieves me no end, as flake foods are many times more expensive than good ground foods of like content. However, ground foods may be made more acceptable by elimination of the larger and harder particles, and by the addition of cod liver oil, wheat germ oil and oil of anise. These oils tend to make the finely ground dry foods float better and at the same time add both vitamins and flavor. Truly, fish that have been raised exclusively on flake foods will still not accept the floating ground foods as readily as flake foods, but they have been acclimated. However, my guppies are raised on both ground dry foods and flake foods, and will accept either with little preference indicated.

The accepted procedure among virtually all knowledgeable guppy breeders for feeding fry during the first three weeks of their life is to feed live baby brine shrimp in great quantities. Some breeders supplement these feedings with shavings of beef heart and liver, and some breeders also use some dry foods. As to the use of dry foods for fry and very small guppies, the best procedure is to place some flake foods in a blender and pulverize the flake foods into a fine powder. The emphasis must be on the size of the food particle. Additionally, the texture of the powdered flake food seems better adapted for the purpose than ground dry food pulverized to a powder consistency. Obviously large chunks of food, regardless of how nutritious, simply cannot be ingested by the small fry.

There is much controversy in the hobby as to the pros and cons of feeding rings. If all of the fish in a single tank are of the same sex and the same age, I think that there are certain benefits to be obtained in the use of the feeding ring. The food is concentrated in one place and the guppy becomes adjusted to searching for his food in that area. Too, he is stimulated by the sight of other fish feeding in immediate proximity to him, and competition in the same restricted area. If you have guppies of different ages, and/or mixed sexes, the larger fish and more aggressive females make the use of the feeding ring under ruble. Males with luxurious caudals seem reluctant to approach the feeding ring, and smaller fish are simply crowded out. With optimum conditions of fish segregated by age and sex, the feeding ring not only allows you to correctly gauge the proper amount of food to be fed at a single feeding but also seems to stimulate appetites and longer periods of feeding.

## EFFECTS OF TEMPERATURE

A few days ago, I received a copy of the quarter-annual publication of the Singapore Guppy Club. In a fascinating article on the history of guppy breeding in Singapore, I was interested by the following

commentary: "Taking advantage of Singapore's ideal climate for breeding guppies, they (pioneer Singapore breeders) were able to in a few years export these guppies to their original countries." The author of the article also makes the following observations: "A high percentage of our prize winners were bred (by women) in our Singapore housing flats...women, by nature, tend to spend more of their time at home looking after the family Guppies bred under their motherly care in the living room of the housing estates, have a tendency to grow faster."

While I have no specific information on the tank temperatures maintained by the Singapore breeders, I note that Singapore is located less than 100 miles north of the Equator, and as you would suspect, has a hot and humid climate. The daily temperature range annually averages a low of 74°F and a high of 88°F. My experience with Houston summerers tells me that these breeders are going to be hard put to maintain tank temperatures much below 82° without the aid of air conditioning. I also speculate that the housing flats are air conditioned, with tank temperatures approximating 74-77°F. I have seen color slides of these fish, and can assure you that the Singapore guppies are very large and very gorgeous specimens.

As a contrast in technique I will tell you that one leader in IFGA competition in North America is Chris McKay of Toronto, Canada. While I have some conflicting reports, I understand he maintains his tanks at somewhere between 68-72°F. His fish do not begin to take color until they are about three months of age and do not participate in active competition until they are a minimum of nine months of age. I understand that his fish do not achieve maximum size until approximately one year. McKay gives two feedings in the morning and several feedings in the evenngs, but the fish are not fed during the normal working day. His fish remain in active competition until two years of age or more, and have great longevity.

The apparent contrast in these techniques, raises the question as to the optimum temperature for maximum development of guppies. In their native environment in Trinidad, guppies encounter an average range of temperatures between 75° to 80°F, with temperatures in shaded areas dropping as low as 65°F. The late Paul Hahnel maintained his tanks at 75°F while Frank Ager favors 80°. The late Myron Gordon, in his excellent booklet "Guppies as Pets", suggests an ideal temperature range of 72-78°F. Dr. C. W. Emmons, in his recent book, suggests a range of 75-80° for breeding, with fry raised at 80°. Now if we were not for the fantastic success of Chris McKay, it would be easy to settle upon a range of 76-78° as a comfortable compromise for the ideal temperature to promote growth. But how do we go about experimenting Chris McKay and, even more important, what effect does temperature have upon the growth of guppies?

## HOW TEMPERATURE AFFECTS GROWTH

As author W. H. Hastings observes in "Fish in Research" (Academic Press, 1969), the question of temperature is complex because, while a number of studies have been made on the effect of temperature on growth and food efficiency, few have been concerned with maximum growth or optimum conversion. I hasten to add that all of the scientific research that I've been able to find has been misdirected to less significant fish such as catfish, salmon, carp, trout, etc., and nowhere has the scientific community gotten down to really meaningful research on wild guppies. Let me further add, that while misdirected, there is an abundance of research available to anyone interested, the biggest problem is to digest and interpret the plethora of information. With this in mind, let us explore the problem of optimum temperature as a stimulus to growth and speculate on some of the answers.

Basal (maintenance) metabolism is the minimum level required to support the animal body under resting conditions. Basal metabolism has not been measured in fish, but standard metabolism (estimated by oxygen intake) has been measured and defined as the approximate equivalent to basal metabolism in man. Similar to findings for warm-blooded animals, experiments with fish indicate that within a defined

range of temperatures the metabolic rate increases approximately 10% for each degree Celsius rise in body temperature. Experiments indicate that over a range of 5-35° C standard metabolism of goldfish increased to its highest value at approximately 30°C. Of course, you have already observed in your own tanks that your fish at very cool temperatures remain fairly motionless and consume very small amounts of food. As the temperature rises, the activity rate sharply increases, as does the appetite level. At the lower temperature the maintenance requirements of the fish are minimal, and as the temperature rises, the metabolism, activity and appetite accelerate sharply. However, you have further observed that at very high temperatures your fish again become sluggish and eat poorly.

But there are other factors that come into play that complicate the issue that you may have thought to be merely the change of metabolism based on temperature as an independent factor. First, the metabolic rate of a fish increases following food consumption, and this increase is attributed to what is known as the specific dynamic action of the food. The metabolic requirements of fish kept on unrestricted rations may be 3 or 4 times as high as fish kept on maintenance rations. Secondly, within the limits of the optimal temperature for a given species, a rise in temperature usually leads to an increase in the rate of digestion. Thus, in one experiment the digestion rate at 15-20°C was 3 times higher than at 1-5°C. I must at this point, sadly relate that the temperature for optimal rate of digestion is not in the range of temperatures for maximum growth. Accordingly, divorced from other factors that affect metabolism, such as lighting and rate of flow of the water (which induces swimming activity), the interrelation of temperature and nutrition makes the problem extremely complex.

While there are many other factors which affect fish in their native environment, species of fishes that are found in both warm and cold climates have great differences in rate of growth and the age at which they achieve sexual maturity. In Louisiana, the largemouth bass may spawn after one year, and in Ontario, Canada, not until the fourth or fifth year. However, while the rate of growth and sexual maturity differs sharply between the various climates, the ultimate size of the largemouth bass seems not to differ.



It would be convenient if we could generalize and apply these observations to both the largemouth bass and guppies. The truth of the matter is that we cannot. Unlike terrestrial vertebrate groups, most fishes have the capacity of sustained, though diminishing, growth throughout their entire lives if sufficient food is available. In other words, most fishes, in contrast to birds and mammals, do not cease growth after they have reached sexual maturity. The male guppy is a well-known exception to the above stated general rule. The male guppy enjoys a highly accelerated rate of growth until it attains full sexual maturity, after which time the rate of growth greatly diminishes, and shortly thereafter terminates.

In experiments conducted by Dr. M. E. Brown, in 1957, it was determined that with adequate supply of food available, brown trout grew optimally between 45°F and 48°F, and also between 61°F and 66°F. Although appetite was high once the water warmed to 53°F, maintenance requirements also increased most rapidly between 58-62°F, then tapered off and became almost constant when 68°F was reached. In the book, "Ichthyology", published by John Wiley and Sons in 1962, the authors concluded that optimum temperature for rapid growth are those at which the appetite is high and the maintenance requirements low, whereas, minimum growth occurs at intermediate temperatures when maintenance requirements are high because fish are most active. In the brown trout, at temperatures below 45°F, maintenance requirements are low, but so was appetite, and above 66°F appetite again diminished while maintenance requirements remained at the same high level. Thus the brown trout achieved optimum growth outside the temperature range where it showed maximum activity.

While I have found little information on the effect of temperatures on growth at various stages of development, one experiment with pre-adult desert pupfish indicated maximum growth at a water temperature of 30°C with optimum food conversion at 20°C, while older fish make better use of food at lower temperatures than do young fish. As a general proposition, the metabolic rate of small fish is greater than that of large fish, and accordingly the caloric nutritional requirements are higher. Even small differences in fish length may account for large differences in caloric requirements. From my reading on the subject I get the suggestion that assuming an adequate food supply, younger fish (and particularly fry) enjoy optimum growth at higher temperatures than somewhat older fish. It should be noted that the metabolic rate is determined by the consumption of oxygen, and care should be exercised that young fish are not overcrowded. Because of the stimulus of competition in group feeding it is necessary that to achieve optimum growth that the fish be raised in numbers. In view of their small size, it would be easy to over-crowd the aquarium without taking into consideration that a small guppy has almost the same oxygen requirements as a larger guppy due to its increased metabolism.

Now, back to Mr. McKay and our Singapore breeders. I can authoritatively tell you, from first-hand experience, that at 70°F the activity rate of guppies is greatly less than at 80°F and that at 80°F food consumption is significantly higher than at 70°F. From Dr. Brown's experiments, it is evident that there are two ranges of temperature that encourage optimal growth. It would appear from a cursory examination that Mr. McKay may have found the range of temperatures at which minimum requirements are low and corresponding appetite high, at the lower range of 68°-72°F. The Singapore breeders may have found a temperature range for optimal growth at which point appetite is highest in relationship to activity and maintenance rates.

I hasten to remind you of the differences in feeding techniques employed by McKay and the Singapore breeders. McKay achieves his optimum growth with minimal feeding requirements, whereas at the higher temperatures, the Singapore breeders are obviously continuing feeding the fish. It should be noted also that the longevity of a guppy raised at near 80°F will, in a few cases, exceed sixteen months, whereas guppies raised at near 70°F temperatures will commonly achieve ages in excess of two years. In contrast, the guppy raised at near 80°F temperatures will be fully matured at less than nine months, whereas the guppy raised at 70°F will likely not achieve full maturity until approximately one year.

Accordingly, your selection of the proper temperature range will depend upon a number of factors that are best related to your abilities and requirements. If you are unable to give your fish continuous feedings, are interested in raising prize guppies with longevity, and are not interested in rapid maturity for commercial sale, I would suggest the McKay method. If you can feed your fish continuously, are more interested in rapid maturity at expense of a shorter life expectancy, I would suggest a temperature range of 76-78°.

(Reprinted from "The Fish Fancier" (Houston Aquar. Soc.) Sept., Oct., and Nov. 1971.)

GUPPY ROUND TABLE APRIL 1972



## PROLONGING THE LIFESPAN

by Midge Hill



The normal lifespan of animals can be extended as much as 100% by reducing their diet by controlling the temperature of their environment. Significantly, it is possible to selectively prolong certain stages of life, either the reproductive stage or the period of old age.

The life-prolonging experiments have been done on rats, mice, rousers and water fleas according to Dr. Nathan Shock and Dr. Charles Barrows, both of the National Heart Institute, Baltimore City Hospitals.

By feeding rats one-third less than is customary, the lifespan was extended 50%. The lifespan of rousers was lengthened 100% by either cutting down on their food intake or by reducing the temperature of the water in which they live. In the case of diet regulation, the reproductive stage of the life span was lengthened, but childhood and old age were not affected. Lowering the temperature had the effect of lengthening the old age stage of life.

There is a catch, however, in prolonging the reproductive stage via diet reduction. The diet regulation has to begin in childhood. Reducing the diet of adult rats had no effect on lifespan. And with reduced diet from childhood, the resulting animal would probably be smaller not very good in these days when larger and larger guppies are the goal. But it does work for guppies. Dr. Larr uses the reduced diet technique to keep his genetic research guppies alive for up to four years. Longevity is his biggest concern, and is so important to his research.

However, prolonging the old-age stage of life would be a great way to preserve these older top-winning show guppies so that they would be around to win show after show. Just keep the oldsters in the corner part of the fish room, or even in heated tanks. The scientists do not say whether this lowering of the water temperature has to be started in childhood or whether it could be started later in order to affect the length of the old age stage. Perhaps it would be more effective if begun earlier, but I am sure many breeders will attest to the fact that at least some growth is done by lowering the temperature on show prime guppies as they get older. However, the scientists do go on to say that what happens very early in life influences greatly what happens later in life. They believe that the DNA (the blueprint that transmits the genetic instructions) itself is affected, and the rate of replication is influenced by the kind and amount of various substances in food or temperature, and perhaps by many other factors.

Now, if we could only find such a magic secret to prolonging childhood as well in our guppies, we could grow them to be monsters while they are still in their rapid-growing childhood stage. Just let them mature when they are 2" long, 3" long, 6" long??? This has already been done with other animals such as frogs and insects, but usually requires an operation and sometimes a second operation is required to allow the "giant" child to finish maturing. But this is a whole other subject.

(Reprint from GUPPY ROUND TABLE, Jan. 1969)

A renowned aquarist, Midge Hill, has been keeping and breeding Guppies for twenty-three years and is a member of the Guppy Hall of Fame. Active in the showing and judging of Guppies throughout the United States from the time Guppy competition first started in California, Midge has won numerous trophies, including an IFGA Championship for the Albino Class. The author was one of the founding members of the Pan Pacific Guppy Association in 1965 and served in many capacities for this Association, including the office of President. She also originated its publication, "Guppy Roundtable" which she edited for six years while also serving as Guppy Judging Chairman and Seminar Instructor. Currently a lecturer, fish photographer, artist, and author of numerous articles on Guppies and related subjects, Midge is also active in the International Fancy Guppy Association where she has served as a member of the IFGA Judging Board since 1974. In addition, she edited the IFGA Bulletin for three years. Midge Hill is professionally associated with the aquarium hobby as one of the founders of Golden State Aquarium, Inc., and also as a Contributing Editor for Freshwater and Marine Aquarium Magazine.

## WHAT TO DO WHEN THE BABIES ARRIVE

by Jeannie Morrow

In that classic literary style called "True Confessions", I must begin by telling you that my reason for writing all my lurid & ns down (for God and whenever) is so that I may prevent some poor unsuspecting beginner from following my same disgusting footsteps. If I can save one soul from my fate, it will have been worth it. There are some things that my back issues of the brain and my mother never told me.

My advisor John Wolcott, former IFGA President, now residing here in Texas, had told me how to acclimatize my newly arrived fish. You float them in the tank to even the water temperatures first. Then, by adding small amounts of water (approx. 2 ounces) from the tank to the shipping water the fish are in at 10 or 15 minute intervals until they are in over half tank water. You get them used to the pH balance of your tank this way. He may have warned me about a few other things too, but he was so intoxicated with all my new found knowledge it may have slipped by me.

**My Story Begins.** When the weather god "IT" looked as if he would finally be nice, I got in touch with the IFGA breeder up North who was to send me my very first good strain of fish. "IT" had been "nice" up there (no, so the breeder said, he would mail my fish the following Monday. He also told me that he was sending me eleven fish, not just three! Four strains in all! I was so excited.

I hurried to get my tanks set up to age my water. One thing no one ever tells a beginner is how to test a tank for leaks. It's one of those things that everyone knows. **Advice No. 1 - Don't wash the tank before you test it.** I did and found that they all leaked. Then I discovered that by washing the dust off them, as any "neat" person would do, I had gotten water under the molding on the outside. Even though I had wiped them dry, this water gradually soaked out, wetting the paper towels I had set the tanks on to detect any leaks. Being as brilliant as I am, it only took me 3 or 4 "leaking" tanks to discover what was happening. After that none were found to leak. I had to retest the "leakers" and found them quite sound! Amazing.

I set up five 5 gallon tanks full of water, lined side-to-side on the top of one of my angle iron racks. Their filters perked happily. The airline hoses to each tank were neatly held together by kitchen tie-wraps into a cubic along the rear of the tanks. It was magnificent!

It was now time to do that simple little test "everyone" already knows how to do. Except me! John Wolcott explained it all about it to me, but "talking about" is not the same as doing. Armed with my Wardley's Super Senior Deluxe Ph Test Kit, I threw caution to the wind and did my first test. I would like to take a survey among the veteran breeders on "How long did it take you to get that sweet little glass vial exactly 1/2 full of the water you first tested?" It's such a cute innocent-looking thing! It either sucked itself full or emptied completely as I tried to get it only half full. It probably has something to do with the settling up and breaking off of the "surface tension" in the vial. And I know it. It took me 5 minutes.

Then, comes the blue stuff (bromine thymol blue) says the plastic flip-top bottle. Put 1 drop into the half full vial. What could be simpler??

I was afraid that the blue stuff would come out of the vial when I tilted the bottle over the vial. (I also didn't know that you can center the little raised edge, where the drop is to come out, by resting the bottle



right on the vial itself before you squeeze out the drop. So, holding the bottle at "long distance", hoping to center it over the vial before this drop "ran" out, I quickly tilted the bottle. It not only DID NOT run out, but I soon found out that no ordinary little squeeze was going to get it to drop either. Bracing my "vial hand" on the table and my "blue stuff hand" on my "vial hand", I centered everything up and squeezed like "#\*0#1! Out popped the elusive blue drop which hit the side of the vial and came to rest exactly half way between the water line in the half full vial and the top. I tried tapping and stomping and temper tantrums but there it stayed. I do NOT recommend tilting the vial to catch such a drop. Dump it before it dumps you.

Texas water is dark blue and is no where near the chart provided. Blue means "Alkaline". You add Sodium Bicarbonate to make it turn more yellow which means the water is "Acid". You add Sodium Bicarbonate (baking soda) to yellow to make the test vial more blue. Yellow plus blue makes green and that is called "Neutral" that's where guppies like it most. Right in the middle. Just follow the color chart. HA.

Someday I intend to propose that the IFGA use this chart as a test for color blindness for judges! My eyes were crossing each time I tested after an addition of sodium bicarbonate. The instructions in the kit aren't clear about how much to add to effect a change, so I had to keep adding and testing many times. Blue is no longer my favorite color.

I managed to overshoot neutral into the yellow range, naturally. It didn't occur to me until later that could have just added some good ole Texas blue tap water. Now was my chance to use the other cute little shaker for awhile. I missed what I thought was a little. "There - that ought to do it."

"Christmas" arrives that Wednesday, thank goodness the breeder had carefully marked the bags, so I could match the right males and females together. I started the acclimatizing procedure. They were the most beautiful guppies I had ever seen! I should have suspected "IT" was up to something. In talking later to the breeder by phone, he told me that no sooner had he mailed the package, "IT" started turning cold again. The males of two of the strains were D.O.A. The breeder said he'd send reinforcements to my rescue. I can't get over how nice IFGA people are. Still, it was a sad moment to see fish so beautiful but dead. Such mishaps on shipping are rare, I understand.

Once the acclimatizing routine was completed, I sat back to admire the survivors. They seemed a bit nervous and skittish - "Spooky" is a good word. The strain #1 male and two females just hung there not doing much. The pregnant female in the strain #2 tank was attacking the catfish, then the male or not pregnant female, whichever was closest to her. The strain #3 single female looked back at me accusingly as did the two "widows" in strain #4. Some of them ran up and down the tank sides as if trying to escape. No one was hungry.

"They" I feel better in the morning after a good rest from their trip, I thought. We all went to bed. The next morning, they were worse. The male in strain #1 was hanging in between the bottom. Strain #4 and #3 were sinking clamped to the corners, and the strain #2 male was gone. GONE??? Oh, no!

It took me an hour to find it in me and longer to figure out what must have happened. I got the biggest clue as I watched the pregnant female try to run the other female and the catfish up and out of "her tank". The water was too close to the top. I really felt bad. You don't have time to cry when you know you have other fish in trouble. Why I never retested the tanks after adding the baking soda and I have no excuse. I started slowly bringing the pH back down with the sodium bicarbonate. It took me a couple of days to get it near normal. I called John Wolcott to tell him my sad tale. He told me to lower the water level a half inch on shipped in fish, then raise it about a half inch per day up to 1 inch from the top. This lets them get used to their new tank. I did what he said.

Burial services were held the same day. Next of kin was notified. He assured me that a replacement for my high jumper would be sent with the others. It was sure hard to admit I'd lost another one.

As I write this, my strain #1 male is making a push at one of his "sweeties". The aggressive pregnant female is in her very own tank, which is divided with one of the baby dividing screens that John gave me for the maternity ward. I pace back and forth occasionally as is traditional when the "blessed event" occurs.

I had hoped to impress everyone with my expertise by this second writing with tales of "adventures" perfect and this is how I did it! Instead, we have "The Confessions of a Sinner" Beginner's Beware! ...

1. Remember to lower that tank level - especially for new fish just married.
2. Never assume that you added the right amount of "SeaT" to change your pH level! Always check after each addition of either chemical.
3. Guppies should act like guppies. If they act "spooky" find out what is wrong!

See Ya'll in St. Louis!



## GUPPIES AND COLD WATER

By Mike & Cheryl Khalid

Last year we had shipped 21 entries to a guppy show in the Mid-West, the fish were entered in the show and they died fairly well in placing. All our entries were returned to us and when we picked them up at the L.A. International Airport, I knew something was wrong. The box was very cold, on opening the box I found every one of my entries lay on the side motionless. I immediately called the Airline Representative who could only shrug his shoulders and say, "It's the change in the weather, we are not responsible for live delivery."



So, I brought the fish home and I floated all the bags and left them for about an hour. I could not accept the fact that my best show fish that we had worked so hard on were not dead. Well! About an hour later I returned to the fish room and to my surprise I found that most of the female entries were up and swimming slowly. I immediately released them into the tank. Since the females were swimming, I also released all the males, too. Much to our surprise, most of the fish were up and swimming within the next hour. We only lost 3 of the 21 entries, which was great as far as we were concerned.

This prompted us to conduct some cold water experiments to determine if guppies can survive in extreme cold water. Here are the results of our tests:

WATER TEMP.	70°	65°	60°	58°	55°	52°	50°	48°	45°
CONDITION-MALES	G	G	G	G/S	S	S/H	H/5	D	H/4 D H/5 D
CONDITION-FEMALES	G	G	G	G/S	S	S/H	H/2	D	H/3 D H/6 D

NOTES: Fish were left overnight approximately 2 hours in the water temperatures indicated above.

The experiment started with 20 Males, 3 months old and 20 Females, 3 months old. These fish were from one batch of fry from our H/H strain.

G - good condition.

S - slow swimming, listless with very little swimming.

H - motionless on bottom - returning to normal in warmer water.

D - dead.

Of the remaining 4 females and 6 males, we found them to return to normal and remain healthy throughout the remainder of the year.

Unfortunately, I could not drop the water temperature below 45° F to determine survival in colder water.

Since this experiment, I have successfully maintained strong, healthy fish in 65° to 76° water with no ill effects.

GUPPY ROUND TABLE MAY/JUNE, 1978

## EARLY GROWTH IN YOUNG GUPPIES

by Bob Fisher

*About the author: Bob Fisher was one of the most successful guppy breeders around 1965, as well as the author of some of the finest guppy information published. An officer and member of Guppy Associates of Toronto, Bob wrote this article for the March, 1966 issue of "Rugosa Times". This article was reprinted many times including the May-June, 1971 GK.*

One of the most disappointing and discouraging things which can happen in the guppy hobby is to obtain some prime breeding stock and then fail to produce offspring equal to or better than the original parents. Many new hobbyists are quite disillusioned when their baby guppies fail to grow quickly into the healthy, husky, large-bodied fish they expected.

We have been asked many times, "How do you manage to grow them so large in such a short time?" or "How can I get my fish to grow fast?" Well, right at the beginning let me be the first to admit we do not know all the answers. Like everyone else we are still learning new things every day but there are a few things we have learned from experience which we would like to pass along, particularly if you are a newcomer to the hobby.

The first and foremost requirement for the raising of young guppies is a well set up tank. Now by this we are not referring to a beautifully planted aquarium or show tank, but rather an aquarium of the correct size and shape, located in a convenient place away from direct sunlight or chilling draughts, clean and not leaking, with water of the correct temperature and chemical condition, provision for adequate filtration and ample lighting, all this coupled with a tank maintenance schedule rigidly adhered to by the hobbyist.

Since we are dealing with rearing guppies only, any comments from this point on refer to guppy babies from birth to age six weeks. It is our firm belief that if a fish is ever going to make it at all and become a fine show specimen, it must be showing good potential show qualities at six weeks of age. This, of course, is not a hard and fast rule as different strains of guppies have quite different growth characteristics, but as a general guide, six weeks should be enough time to decide if your youngsters are doing well.

So we think that the first six weeks are the most important in any guppy's life. How well they progress afterwards is spelled out by the kind of treatment they receive as babies during this important period.

It is our belief that one cannot successfully rear babies and adults in the same tank, primarily because the babies are constantly nervous in the presence of larger fish, thus one sees them herded into a corner or huddled in the plants, not free to roam at will. Now if we ourselves had to spend all our time huddled, scared out of our wits, we sure wouldn't have too much opportunity for eating or exercise...it is surely the same for baby guppies. They are far more secure when separated from their parents and placed in a tank of their own. Further, if parent fish were fed the high protein diet that youngsters should get, pretty soon they would develop "mud-bugs" grow fat and ugly and no longer swim gracefully...they just wobble their way around, not a happy state of affairs for older fish. Therefore, for baby fish we like to use a five gallon tank. Limiting its population to fifty individuals for the first three weeks, after which we separate males and females into two five gallon tanks, roughly 25 individuals per tank. A plywood stand capable of holding from 18 to 24 of these tanks can be easily constructed and only takes up 60" x 60" of floor space in the fish room and is well worth the initial investment in providing plenty of tank space for new arrivals. Some of the batches of young fish are larger than fifty.

When this happens we generally split the dropping into two parts and house each half in a separate tank to prevent overcrowding. It isn't so much the excess food which fouls the water but rather the feces

and wastes of the fish themselves...hence less fish, less chance of fouled tanks and evil-smelling water.

We have found water temperature to be most important and insist that babies only really grow when kept at 80° to 82° consistently. Avoid sudden chills, your baby fish do not like it any more than you would, and any sudden shock like this could set them back a week or more.

Like many other hobbyists we prefer to feed our fish a small quantity of food often, and endeavor to provide them at least six meals a day, spaced several hours apart. We have noticed that the warmer water keeps them eating well when they eat they grow, which is what we are after.

Their main dietary item, of course, is newly hatched brine shrimp, on which they will gorge until their bodies are swollen and they look like half-bearings with fins. They will continue to gorge themselves like this every two hours all day long. There is no question that brine shrimp are an absolute must for young guppies. We know of no other food which will promote such rapid growth in young fish. A shrimp hatchery should be an important part of the hobbyist's set up: it should never be thought of as a cumbersome extra. We have a so found the young guppies will greedily eat any dry powdered food which has been ground down to their bite size. If it is small enough for them to swallow, they will accept it readily and your tanks will not become fouled by food left over too large to be swallowed. We prefer to feed alternate meals of shrimp and dry foods, making sure they receive at least two feedings of shrimp every day. The final feeding is right before lights out is always dry food so that they will have something substantial in their stomachs during the hours of darkness.

We have seen many batches of young fish raised on dry food alone, without the shrimp, almost without exception these fish are small, undersized runts when compared with shrimp-reared fish of the same age. This same diet is continued for the whole six week period, the only difference being the amount of food fed as they get older and larger. One has to learn exactly how much food to give each time without overfeeding. If there are at least five shrimp swimming in the tank after half an hour, we know we have given too much, however if they are all finished in five minutes, they will need a larger quantity the next time. This is only a rough gauge, but it seems to work for most people.

Concerning tanks, water and maintenance chores: a clean, sterile tank is a prime necessity with a filter large enough to do the job and sufficient aeration to permit filtration. Our experience has been that some hobbyists do not give their tanks enough aeration. Since oxygen is essential for guppy growth, we are firm believers in plenty of rapid filtration to remove wastes and gases detrimental to the young fish and to promote crystal clear water. How can a filter be expected to perform the job for which it was designed when the air is hardly trickling through it? A tank can become fouled overnight if the filter is not operating efficiently. We keep our filters charged with fresh bone charcoal, and glass wool, making sure all dust is washed from the charcoal first. We try to change the glass wool in baby tanks every week, the charcoal every third week.

We use only straight tap water, adding one level teaspoon of non-iodized salt per two gallons as a disease preventive. The water is aged for two days at least, with both filter and lights operating. Next the temperature is checked. Finally the fish and scavenger snails are added by floating their containers until the temperatures are equalized. We prefer to use red ramshorn snails for this job as they multiply fast and have large appetites so do a good job of cleaning up food the fish leave. Every week 1/3 of the water is siphoned off picking up the bottom sediment. Since there are no plants or gravel this is not a difficult task. We replenish this water from a 20-gallon supply of aged water kept especially for this purpose...ready for use at all times. Because the salt is already added, the amount put back into the baby tanks is equal to the amount removed by siphoning, therefore no salt build-up occurs. If we should get a cloudy tank by overfeeding, we change the water more often. These constant water changes do not affect the young fish...in fact they seem to thrive on it.

Our entire philosophy regarding tank maintenance could be summed up as follows, "if it isn't there it can't cause trouble". Hence, we try not to overfeed, we clean filters regularly, we do not use plants or gravel, as we feel these only collect dirt, we use only clean sterile nets which are rinsed in scaling water after each use to destroy bacteria. Our brine shrimp hatching bottles are rinsed, scrubbed and scalded after each hatch (a piece of steel wool on the end of a stick does a nice job of this). By disciplining ourselves to rigidly adhere to these methods of growth in these early weeks, our guppies have attained 1" at four weeks and 1 1/4" at six weeks - again a lot depends on the strain and these figures should not be taken as more than a general guide.

At six weeks of age they are again moved to more spacious quarters and their diet is adjusted for sustained growth, but this is another story. It's well to note that from four weeks onwards, male fish tend to slow up in their food requirements and do not consume as much as females, so it is well to watch out for over-feeding problems at this age. We are satisfied that any newcomer to the hobby can safely follow these instructions and successfully raise a batch of babies into potential show quality fish... give your fish a good start and you will not be disappointed. ###

**Editor's Note:** Although the above article is about 13 years old, techniques have not changed that much. Most breeders now would not use five-gallon tanks but use instead 15 or 20-gallon tanks once the fry are three weeks old. Small tanks are still used for the newborns as it is easier for them to find the food. The use of salt, then as now, depends upon the breeder's preference. I've never seen the value of washing charcoal as you only reduce its potency, especially if it is activated charcoal, and the fine charcoal won't hurt anything.

For those of you who think you're already doing a good job of raising your babies or for those of you who have resigned yourself that your strain is smaller than the average - try this simple test. When the next batch of fry is born, put six of them in a five-gallon tank. Add a bit of Tubifex worms. For the first few days you can feed baby brine shrimp and powdered food until you see them feeding on the Tubifex. Make sure there are always Tubifex in the tank which will be difficult once they are two weeks old. Add other foods if you think they will accept it. After four weeks (the babies aren't at least 1 1/4" longer than their brothers and sisters who got your normal treatment) then you are doing a good job or your strain is in error. Incidentally, for those with limited facilities, this is a good way to obtain a few show quality guppies for competition.

G. PRY RO, NIDDALE JULY 1978

## CURE FOR SWIM BLADDER TROUBLE

Place the affected fish in a tank or jar and bring the temperature down to 60°. Prepare a tank with water 12 inches deep at the temperature of 90°. Transfer the cowed fish quickly to this water by net. The fish will breathe very quickly and try to rise in the water perhaps about 4" at first and it will fail to the bottom. With its remaining strength it will dart to the surface, give one big gasp and will be cured and able to swim normally again. (reprint from Tri-City Aquarium Society)

## CARE OF THE YOUNG GUPPY

by Randall Robbins

Initial care of the young guppy very much influences its final development. Few fish are groomed into show winners with special care only as mature adults. Excellent mature fish don't just happen. Instead, they are the result of much intense care starting the day they are born.

Tank care and feeding are two vital considerations in getting young fish started to develop into fine mature guppies. Tank care can be broken into temperature of the water, filtration, water changes and the number of fish per unit of water. Young guppies should be maintained at a water temperature of 76 to 80°F. At these temperatures they consume more food, allowing them to grow and develop much faster compared to lower temperatures (72 to 74).

A tank without gravel is best for young guppies. A box filter with medium air is the adequate filtration. The filter should be kept clean with sloss changed every two weeks. Before changing the filter the sides and bottom of the tank should be wiped with a clean sponge and the water change should be made in conjunction with the filter change. Water changes should be made when the fish are two weeks of age and weekly thereafter. A 35 to 50% change weekly should be adequate with aged water at the same temperature. If un-aged water is used, changes may be dropped to 20 to 35% weekly as fish may become uncomfortably full; larger changes are made.

The entire filter (20 to 50) can be maintained in a five gallon tank the first two weeks, but then should be given more space. At one month of age young guppies should be placed in a tank by themselves with no more than two fish per gallon of water. As the males develop they should be given one gallon of water per fish.

Feeding of the young fish is as important as the tank in which the fish are kept. The size of the food is of vital importance. The best food in the world can be fed, but if it is too large for baby guppies to consume, it does little good. Young fish should be fed a variety of food with at least one live food daily.

Good live foods are newly hatched brine shrimp and microworms. Other good foods are frozen baby brine, grinders, worms (at two weeks), a variety of ground air and fluke foods, and frozen beef heart. Flake and granular foods should be ground between the fingers to make it small enough for consumption. Frozen beef heart can be chopped in a blender before freezing and scraped very finely from the frozen mass for young fish. The secret to feeding young fish is to feed a small amount frequently. Young guppies should be fed at least five times daily (preferably a different food at each feeding).

Of further importance is the maintenance of the feeding schedule. It cannot be done every other day, but must be carried through every single day, and the final results are amazing.

reprinted from Madison Aquarium Club 7-76

## BRINGING IT ALL TOGETHER CARE OF FRY & MAINTAINING THE STRAIN

The following articles all touch on the importance of properly raising your fry, careful culling so you are raising only the best, and the importance of learning a few basics so that good strains can be maintained indefinitely.

### CARE OF FRY

The way fry are cared for and fed from birth until three to six months of age, is the real test of whether an aquarist is really serious, effective and successful. Russ Graham, in his article in "Montreal Aquarium Society Bulletin" (Nov. 1973) covers five important aspects of good care of fry.

#### 1. SIZE OF AQUARIUMS

The dimensions of an aquarium are extremely important in effectively bringing a fish to maturity. If the aquarium is too small, the fish tend to become listless, their appetites lessen due to lack of exercise and there is a real chance that they may become stunted. If it is too large (especially during the first six weeks) they have great difficulty in finding their food. My rule of thumb regarding tank size is:

- a. free swimming to three weeks - 4 oz. of water per fish
- b. three weeks to two months - 8 oz. of water per fish
- c. two months to six months - 1 gal. of water per fish

Of course, these figures are very general. The important thing is to give each fish enough space to stretch his fins, but not so much that he and his food have trouble meeting.

#### 2. CONDITIONS OF AQUARIUMS

We must be sure that each baby fish is brought up in clean water with the optimum amount of light and the right water temperature. My preference, generally, is for the use of a bare tank from the newborn to the two-month stage. To my mind the biggest advantage of a bare tank is that you always know how much of the food given your young is actually eaten. Also, the micro worms, brine shrimp and other types of small live food remain continually accessible to the young for longer periods of time.

#### 3. MAINTENANCE

Maintenance is not only necessary, but essential in the health of growing young. Water changes and syphoning off of uneaten food and excrement are required on at least a weekly basis. I begin water changes when the fish are ten days old. Usually I start by changing 20% per week until the fish are two months old. Then, I change 50% of the water every four or five days. This allows me to keep a few more fish in a smaller amount of space than normal. Some authorities say that fish give off a "growth inhibiting hormone" in their excrement which, if allowed to build up in the water, will apparently stunt the fish. (World Champion Cuppy Breeder Joe Rack does even more frequent water changes than I do.)

#### 4. FEEDING

Young fish require practically non-stop nutrition. During the first six to ten days of their life you MUST attempt to meet this requirement. They can be trained to accept a regularly scheduled and varied diet. If you feed them every three hours one day, then once the next day and five times on the third day, you are asking for problems. When starting with brine shrimp, don't feed it a half hour before lights are turned

out because most of it will be dead and uneaten in the morning. Microworm feedings take place at night and provide food for them in the morning. As my fish grow, try to keep their little bellies full of food all the time. I use dry foods, beef heart, earth worms, daphnia, glass worms, mosquito larvae, white worms, tubifex, fairy shrimp and whatever else I can get my hands on.

#### 5. CULLING

The ways of nature are cruel, cold and final. The weak and deformed are either eaten or destroyed by the strong. In this way nature protects its species from evolutionary extermination. We must replace nature in our aquarium and protect our fish similarly. Any baby fish which is even slightly deformed must be eliminated immediately.

Fish health is definitely a reflection of the quality of their environment and diet. Our children grow up and eventually fend for themselves, but our fish must be cared for forever. #

*Condensed from MONTREAL AQUARIUM SOCIETY BUTTERFLY, Nov. 1973*

### CULLING

There are at least two reasons for culling. One is to make more space available, and the other is because it is far less to spend time and money on fish that aren't worth it.

Barbara Lamb goes into details about the hows and whys of culling in the May 1974 issue of "THE GLADES" for the benefit of those who have not yet developed their own guidelines for culling.

The first culling you may do might be when the fish are very, very tiny. If the spawn is quite large and you know you'd have only a ten gallon tank to raise them in, it is wise to throw half the fry away at the start. I is better to make a net and scoop around a few times gathering babies destined to drown than to keep them all and end up with a tankful of runts.

If raising space is not a problem, then you can keep a full babies for at least several weeks. Some culling can be done before the fry are even sexable every few days give your tank a hard look and search for any culling fish. These might be deformed fish such as specimens with missing fins, misshapen fins, grotesquely formed mouths, cranial bumps, etc.

You won't be able to cull for color, usually, until the fish are becoming sexable. Most strains seem to retain their color at approximately the same time the males begin to grow the longer fins.

A few examples of how you would color cull would be a strain produces percentages of fish showing a desired pattern. These are keepers. Most fish without the desired pattern are best disposed of. If your hag is working blues and greens, you would cull the fish from the spawn which show too much secondary color or wash. Save them only if you have space to devote and are planning to show them in a multi-bicolor class.

In working for tail shape, you would eliminate the ones with serious flaws in their finnage. Also cull those with poor dorsal shape. And there are the runts. Most spawns will have a few fish in them which lag way behind the others. These fish almost appear anemic. You might as well get rid of these.

Perhaps the hardest culling to do is that of old fish, or fish which have been ill and never were the same afterwards. It takes will power to "scratch out" a fish which is obviously over the hill now but has serviced you well in the past as a show specimen and a breeder. But, you should remember that you have young ones coming up which will need the space and food, not to mention your time, and keeping too many oldies will make it harder on the young promising ones.

As a rule of thumb when looking for fish to cull, ask two questions "Will I show this fish?" and "Will I breed this fish?" If we cannot answer yes to one of these questions, the fish goes out.

Ruthless culling will make your cleaning chores easier. It will reduce the amount of food you use and will give the space to work more strains. Guppy breeders and goldfish breeders attest to the fact that culling is an absolute necessity.

So, how do you accomplish the "cull"? Pouring down the drain or flushing is perhaps the worst way. We hated it so much we found ourselves putting off the job of culling until we weren't doing it anymore.

A "humane" way has been described as putting the fish in a jar with several Alka Seltzer tablets. I didn't care for this because I was forced to watch the fish swim crazily while they were being "put under." It may be humane to the fish, but isn't too pleasant for the breeder.

Our method is to keep large cichlids and feed the cull fish to them. It is more "ecological" because, after all, big fish eat little fish in nature. Death is instant when the big fish strikes so there isn't time for much pain. The cichlids tanks are located conveniently in the fish room, so culling only takes a minute.

I hate to cull, but recognize the necessity of it. The method we use may not be your answer but whatever your method of culling is, I'm sure you'll find it necessary for successful breeding results. #

*(condensed from NASHVILLE AREA BETTA BREEDERS NEWS as reprinted in "THE GLADES",*

## MAINTAINING THE STRAIN

"A ways I hear about who used to be but he used to be like the 30 pound bass that would have been a record if it hadn't gotten away."

"About all those Reds, Blues, etc. that were supposedly so great...where are they now?" According to Ron M. Ilcurek (FLARE, March 1974) "the fact lies with the people who breed and were unable to maintain these strains. To be great in the field is to maintain the strain. Otherwise, you fall into the category of the 'Sleeping Wonder Guppy.' The wonder meaning, I wonder if they really were. Why not now?"

Larry Brundage (THE GLADES April 1974) goes into a few reasons why some good strains go downhill or disappear. "After talking to some individuals who consider themselves guppy breeders I find out they are only kidding themselves and many times, other people. They are not true guppy breeders but hobbyists who have guppies breed for them. It does not take much skill to put some guppies in a tank and have them spawn for you, my daughter could do that when she was six years old. These individuals make the necessary water changes, feed the fish regularly and truly believe they are breeding guppies, but are they really?

When asked about the basic genetics and background of their guppies, they have no answer. When asked what method of breeding they use, there is only silence. Spawning records...what are they? Sometimes such basics as water conditions are not even known.

"I am not trying to belittle these hobbyists. If they are getting enjoyment in doing "their thing" they will probably remain in the hobby, but will stagnate if they don't try to improve themselves and their fish. The knowledge that with a little more effort, reading, studying and experimenting they can get and give so much more. This is the part that bothers me.

There is such an abundance of good technical information around just waiting and begging to be used. A lot of this material is written by fellow hobbyists in language that others can understand. Once a hobbyist starts reading and learning he usually gets bit on by the bug and his thirst for knowledge begins.

Which category do you fit into, a guppy breeder or a hobbyist who has guppies breed for him? ##

## REPORT ON BREEDING TECHNIQUES OF THE GUPPY PART 2 - H/B REDS

*Compiled by Maumee Valley Guppy Association (Not for reprint without permission of IFGA or MVGA)*

We have contacted the top breeders of each color class and have compiled the following report. It is hoped that this information will be useful, to all guppy breeders and especially to the novice in help him in the right direction.

This and the following reports should give an insight on how the top breeders approach the breeding of their guppies. The way we can encourage new breeders is to give them a helping hand and to give them the advantage of our mistakes.

For this issue we will report on the Half Black Reds. If there is anything that you can add as fellow breeders please send it in. This report can always be added to. We wish to thank the following for their help with this report:

Ken Klumpel - East Coast Guppy Assoc.	Stan Shubel - Michigan Guppy Breeders
Everett Goid - Gateway Guppy Assoc.	Astrid Young - Australian Guppy Club
Jim McCarty - Maumee Valley Guppy	Harold Armitage - Maumee Valley Guppy
Janey Magnifico - Maumee Valley Guppy	

### QUESTION 1 - HALF BLACK RED STRAINS REPRESENTED AND THEIR SOURCE.

1. Ken Klumpel - A line is my line. My H/B Red is combination of Shubel and Singapore female. A line with 1's female.
2. Jim McCarty - From a Canadian line. Gray bodied.
3. Stan Shubel - From inbred line 1957. I developed in 1960's by backcrossing.
4. Everett Goid - Not known, acquired from a friend.
5. Astrid Young - A show fish male and red/grey female 8 years ago. Two years later a cross.
6. Harold Armitage - Male was from Jan Woodruff. Female from Bob Thompson's male.
7. Janey Magnifico - Two lines: (1) H/B Red male from Hong Kong to Red female then bred 8 generations. (2) Jim McCarty line.

\*\*\*\*The H/B Red line is very popular. Many breeders are attracted to it because it is so colorful. The females seem to be larger and are colorful. It breeds true and is very rewarding. Two of the above lines are related, line 1 & 3.

### FEATURES OF THE STRAINS AS COMPARED TO AVERAGE:

Strains	1	2	3	4	5	6	7
Size	Aver.	Aver.	Small	Good	Small	Larger	Aver.
Tail Width	Aver.	Good	Delta	Large	Wider	Larger	Larger
Dorsal	long	long	good	long	larger	wide	small
Rate of Growth	6 mo.	slow	slow	rapid	faster	slow	slow
Rate Maturity	--	slow	slow	early	earlier	slow	slow
Fertility	good	good	good	not	good	lost	fair
Cannibalism	none	little	none	good	little	none	yes
Susceptibility to Disease	some	less	good	less	less	tail rot	
	split						

\*1 Kept two lines for breeding. Best results line breeding, excellent color.

\*4 Fertility according to which strain is bred. Some of the colored strains are more prolific.

\*7 Color is very good.

\*\*\*\*The H/B Reds seem to have average size bodies with large dorsal fins. The dorsals are long. Three breeders report that their lines mature slow and the other three are faster. On the whole the fertility seems to be good with little cannibalism. The only susceptibility to disease seems to be tail spotting and tail rot which we all are familiar with.

#### BREEDING TRUE:

Strain	1	2	3	4	5	6	7
Time Kept Pure	18 mo	2 yrs	20 yrs	7 yrs	2 yrs	No	3 yrs
Siblings	--	uniform	--	--	50/50	No	3 yrs
% Desired Color	80%	90%	95%	50%	45% *	75%	75%
% With Impurities	20%	10%	5%	50%	5% *	25%	10%
% Different Color				10/15%			15%

\*5. Out of the 50% that were males 45% have desired color. Out of the 50% of males 5% had impurities.

\*\*\*\* Looking at the above chart the % of desired color is quite high. Two of the breeders have had their strains for an extended period. The H/B Reds breed very true with a small amount of impurities. Breeder #6 lost his line after 6 generations because he did not outcross with anything, so he lost size and fertility.

#### METHOD OF BREEDING TO MAINTAIN THE COLOR:

Strain	1	2	3	4	5	6	7
Inbreeding:							
Sibling cross	*	yes	--	yes	yes	yes	yes
Father to Daughter	no	no	--	--	some times	--	--
Mother to Son	no	no	--	--	--	--	--
Line Breeding:							
# of lines	*	2	2	3	*	1	*
Crossed after							
No. Generations	--	4	4-6	3-4	3-6	no	*

\*1 Two males kept. A & B mated to A females. Sibling cross only to maintain two lines.

\*5. One grey and one blond.

\*7 Two matings each time. Crossed every other generation.

\*\*\*\* Inbreeding and line breeding is the practice of the above breeders. I did not use the under red colors and kept the desired colors. Breeder #6 did not cross.

#### EFFECTS ON COLORATION OF CHEMICALS, TRACE ELEMENTS, FOODS, ETC.:

Strain	1	2	3	4	5	6	7
Food	--	none	--	*	--	Variety	--
Chemicals	none	none	--	--	--	--	--
Trace Elements	none	none	--	*	--	--	--
pH of water	6.8	7+	7.3	*	--	hard	*
Comments	*				*		*

\*1 I change water weekly to 4 months after that very little.

\*4 I use color food for darker color. My fish look better in acid water.

\*5 Not practiced in Austria by breeders in our club.

\*7 Need frequent water changes. Also need dark tanks or half-black washes out.

#### METHOD OF BREEDING SHOW FISH FROM THIS STRAIN:

Strain	1	2	3	4	5	6	7
Same method as for maintaining the strain	--	yes	yes	yes	--	yes	yes
Controlled hybrids	yes	no	--	some times	--	--	--
Pure strains	2	yes	--	yes	yes	--	--
Always the same 2 strains	mostly	yes	--	yes	yes	--	--

#### OUTCROSSING - THE EFFECTS ON COLOR:

Strain	1	2	3	4	5	6	7
Blue	--	no	--	--	--	--	*
Green	--	no	--	--	--	--	*
Red	*	*	good	*	*	--	*
Multi	--	no	--	--	--	--	*
Snakeskin	*	no	--	--	*	--	*
Other	--	--	--	--	--	--	*

\*1 (a) Red no good, mostly dark with black.

(b) Snakeskin makes to females, good half black AOX.

\*2 My females carry the H/B. If I use red female, I don't get H/B reds.

\*4 To take some of black out of finnage.

\*5 (a) Half black red is very dominant after 2-3 generations.

(b) Snakeskin this color would be back again pure.

\*7 Original stock the half black was carried by the male only - now the half black is on both.

\*\*\*\* The only crosses made were with the reds and snakeskins. It took like crosses III with snakeskins were successful with breeder #1 and #5.

Question 8: If all of the strains were gone except for one - one male - what would you consider to be the best outcross to make to preserve the color?

1 To any large half black red female with clean red color in tail - no black spots.

2 To half black red female if available. Next red female and backcross her young.

3

4 Red female.

5 I would cross the male with a delta 1 female, which should be red. If the ground color of the male was grey I would cross with a blond female. If the male was blond I would cross with grey female.

6 Back to red female.

7 Good red females.

Question 9: Goals - Picking breeders, and fry expectations.

1 To increase size.

2 To keep black back of dorsal and to get good size. Also to keep dorsal red and not pinkish or white.

4 To get good colored finnage consistently without any spotting.

5 To keep the good red color and to strengthen the black color of the body.

6 To be Guppy Man of the Year.

7 Get good half blacks with no red in body, bright red tail and no gold genes.

# SELECTING BREEDERS - FEMALES:

Strain	1	2	3	4	5	6	7
C/R Ratio	X	--	--	Good Bl	X	2-1	--
Body size	X	large	--	large	X	lg. full	medium
Body shape	--	good	X	stubby	X	stocky	stocky
Body color	X	--	--	Black	X	50% Bl.	1/2 Black
Caudal size	--	--	--	Large	--	large	large
Caudal shape	--	--	X	Delta	X	wide	box
Caudal color	X	*	X	clear	X	red	redshk
Dorsal size	--	--	--	large	X	large	large
Dorsal shape	--	--	X	*	X	parall.	same
Dorsal color	--	--	--	yes	X	ogram	blue-red
Other	--	--	--	--	--	active	--

\*2 Bes. breeder's clear or blue cauda. Hy. one throws some red in leg females that are beautiful

\*\*\*\*All breeders above agree that the caudal color in the females is very important. Body shape, size and color is also important.

# SELECTING BREEDERS - MALES:

Strain	1	2	3	4	5	6	7
C/R Ratio	--	--	--	same	--	1-1	--
Body size	--	large	X	large	X	largest	large
Body shape	--	yes	X	smooth	X	stocky	*
Body color	--	1/2 Blk.	X	1/2 Blk.	X	1/2 Blk.	1/2 Blk.
Caudal size	X	large	X	delta	X	large	large
Caudal shape	X	delta	X	delta	X	Delta	Delta
Caudal color	X	red	X	clear	X	red	red
Dorsal size	X	yes	X	5/16"ht.	X	large	*
Dorsal shape	--	yes	X	Parall.	X	Parall.	--
Dorsal color	X	red	X	patch	X	red	red
Other	--	--	--	*	--	active	--

\*4 When selecting breeders the hobbyist must sometimes try as soon as possible to determine which kind of females will give him the best results. Whether the strain he is working with has females that have round, delta, or shark tail he has to breed them all to find which give best results. Sometimes good results with a clear or partially colored caudal. Other strains give best results when the male is mated to a female with specific kinds of spots. The male guppy shows more of the traits which he passes on to the young but the female it can be watched more closely in my opinion.

\*7 Body shape - Thick peduncle (1" long). Dorsal size - medium parallel gram

\*\*\*\*In breeding of the males, caudal size, shape, color were unanimous. Dorsal size, shape and color were also important. Because you can see the dark red traits of the male these guidelines are easier with the males than the females.

# BREEDING AGES, SIZES OF LITTERS, RATIO OF MALES TO FEMALES:

Strain	1	2	3	4	5	6	7
Age bred M	5 mo.	6 mon.	4-6 mo.	3 mo.	3-4 mo.	4-5 mo.	3-5 mo.
Age bred F	3 mo.	3-5 mo.	4-6 mo.	1 1/2-2 mo.	3-4 mo.	4-5 mo.	2-4 mo.
Aver. litter size	35-40	30-40	30-60	20-40	80	25	15-30
Ratio M/F	50/50	50/50	50/50	50/50	50/50	50/50	50/50

It might be noted that breeder #4 earlier stated that his male matured early, he breeds his females at 1 1/2-2 months of age and his males at three months. That is earlier than the other breeders. The average age of breeding the females is 3-4 months and the males 4-6 months.

# GENETIC TRAITS BELIEVED CARRIED BY THE DIFFERENT SEXES:

Strains	1	2	3	4	5	6	7
Body size	F	F	both	both	both	both	--
Body shape	--	both	both	both	both	both	--
Dorsal size	M	M	M	M	both	both	--
Dorsal shape	M	M	M	F	both	M	--
Dorsal color	M	M	M	M	both	M	--
Caudal size	F	both	both	F	both	both	--
Caudal width	F	F	F	F	both	both	--
Caudal color	M	both	M	M	both	M	--

\*\*\*\*Most breeders are agreed that body shape is carried by both male and female. Most feel that the dorsal is carried by the male and the caudal size and width by the female. Caudal color 4 to 2 for the male.

Question 13 Spec. problems with this strain.

1. More susceptible to infection and to E. coli.
2. Keeping back back of the dorsal.
- 3.
4. Infertility and small litters.
5. Bad caudal colors.
7. None.

# FAVORED ENVIRONMENTS FOR KEEPING THIS STRAIN:

Strain	1	2	3	4	5	6	7
Salt	some	some	--	*	for illness	X	*
Spec. diet	*	varied	--	*	*	--	--
Spec. Environ	--	none	--	*	live plants	X	--
Tank size	3-30	5/10/20	15 gal.	20 gal.	20-30	10 gal.	*

\*1 Four types of dry food and brine shrimp.

\*4 a) One tsp. per gallon per month

b) Some home prepared foods

c) Warm for quick growth, cool to hold.

\*5 Brine shrimp, tetra min, beef heart

\*6 Females keep in 10 gallon tanks

\*7 Two tablespoons per 5 gallon. Tanks size vary 2 1/2 gallon - 1st month 10 gallon after 24 gallon older males.

\*\*\*\*Most use a little salt and a varied diet

# COMMENTS

\*1 Most important was to match color of dorsal to caudal with same intensity of color. Size will come later.

## COMMENTS cont.)

#2 Some females in this line have large beautiful bright red caudals. Nicer than some males of other lines.

#6 Due to being hybrids, was only able to breed for 6 generations and lost the line from infertility.

\*\*\*\*Considering that ten years ago Half Blacks were all lumped together, this strain has come a long way. Today the Half Black falls into 5 categories in the IFGA shows. Breeders have perfected their individual colors and the classes are breeding true as this report shows.

**Editor's Note:** In this and forthcoming reports the conclusions/comments of MYGA that appear after each section will be designated by \*\*\*\*.

## A FEEDING TEST

by Dr. E. C. Larr

One of the big things that shows up time and time again is the ability to raise show type guppies. I mean hereby really high-point fish. A very important factor in all this is feeding. I'll explain what we set up and what we found out.

We took a strain of red delta-tail show guppies. All of the brethren from this particular line would certainly be very high-pointed show fish. Some were superb.

The fry were split up. One tank of test fry were fed the standard way I feed — three times a day...the standard feeding regime being something like this.

### 1st day:

1st feeding: newly hatched brine shrimp

2nd feeding: Golden State Guppy Food

3rd feeding: beef heart

2nd day: 1st feeding: newly hatched brine shrimp

2nd feeding: combination of Tetra-min and Biorel flake foods

3rd feeding: chopped earthworms

Continue to repeat 1st and 2nd days ad nauseam.

When feeding the flake food combination, it is crushed up very, very fine and passed through a fine sieve (like a tea strainer). The main point being to get the flakes small enough so the young fish can handle them easily and not have to wait until the flake itself has become soggy enough for their jaws to tear apart and to feed on. The beef heart was simply run through a blender mixed with gelatin to hold it together and fed in that way. The chopped earthworms the same way — chopped in a blender and some gelatin added to it for firming. Sometimes the gelatin was omitted and the finely chopped earthworms simply fed as such. I could find no measurable difference between the mixing of gelatin with the earthworms and without.

The most startling results from these fish whose parents were show fish, was that we had an enormous predominance of veil tail types — with caudal spreads less than 60°. Remember now, that the parents were high-pointed, very fine deltas with tails beyond 60° by a big measure. The other half of these test fry were fed

eight times a day. This was a constant thing and they were fed all the time. They were fed the following diet and in rotation as given.

1st: newly hatched brine shrimp	5th: Biorel
2nd: Golden State Guppy Food	6th: chopped earthworms
3rd: Beef heart	7th: Tetra-Min
4th: newly hatched brine shrimp	8th: newly hatched brine shrimp

Now this is against my concept of force feeding guppies, but as you know, a guppy's digestive process is such that most foods pass through its digestive system in 25 to 30 minutes, so we simply divided up the twelve hour day and fed this kind of a diet every day.

The results were startling. From these baby fish we had our show quality fish. We had wide deltas, we had robust, large-size fish with essentially no veil tails among them at all.

It is an interesting thing to give some thought to. If you're going to raise large show quality fish to compete with today's standards, they are simply going to have to be fed a big variety of foods and they are going to have to be fed often.

We took just one more step. From the fry that were raised on the feedings of three times a day...after these had reached maturity, we got a batch of young. These young were then fed on the cycle of eight feedings a day (just as our second test tank had been fed).

The results were that they were a fine quality show fish. So even though the parents looked like veil tails, they still carried the genetics of the fine, big delta, and as soon as the feeding program was increased, this became obvious immediately.

So here is the kind of thing you might like to give some thought to. Give it a try, set aside some fish from a strain and really pour the food to them — just keep them eating all the time. They will use young in our eight feedings-a-day tank. Sure, need is a fish that is 14 months old — which to me is very sad, but nevertheless, for those great big show fish with huge tails, an early death is one of the penalties. Really, some of them can swim worth a darn, but they do have enormous wide tails. From this you can see that feeding is of extreme importance.

Genetics, of course, is the first requirement. If the genetic combination is not there for him to become a delta, no amount of feeding will make him become a delta. This was verified by feeding an established strain of veils which had long, slender caudals with an angle of about 45-50°. On the eight-feedings-a-day sequence, they simply became larger fish. So it shows that feeding is not the only answer...the genetics has to be there first.

(This was from the March, 1971 issue of our own G.R.).



## TEMPERATURE

by Dr. Eugene Larr

The range at which guppies can live covers a range of from about 55° to about 100°F. I am sure you realize that there is a much narrower range that guppies like, but it is somewhat amazing that they are such tolerant creatures. While guppies will live at 55°F, they do not like it and will do rather poorly. While the higher temperature of 110°F, should not be used for several reasons, we will discuss one factor of this higher temperature which can be very interesting.

The normally accepted temperature for guppy culture is from about 74°F to 80°F. With this range guppies do the best and will give you the greatest reward for your efforts.

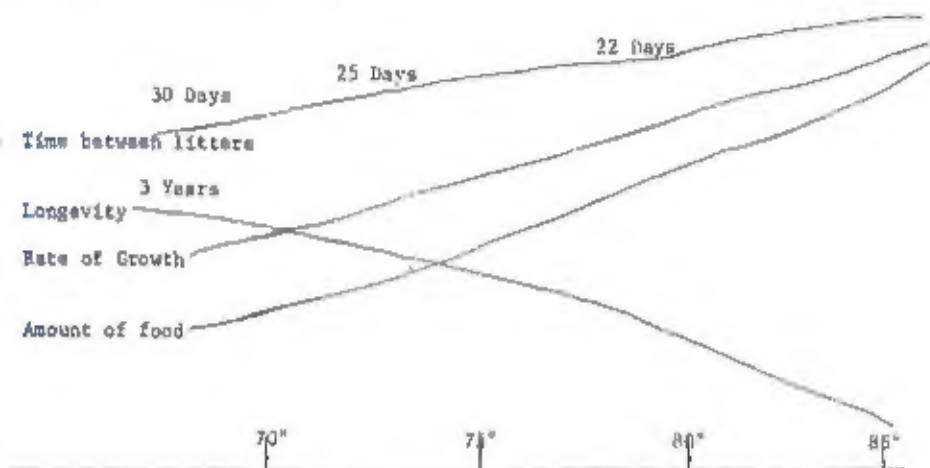
There is a startling effect on the longevity of a guppy as the temperature is changed. A guppy raised at 80°F. from birth will probably be dead in 18 to 21 months, while one raised at 74°F. will live 30 to 43 months. I have a number of fish which are kept at 69-71°F. that are now just over, five years old and are still doing fine.

Just as in almost all the other requirements for guppy culture, there are two paths to proceed along when one is considering temperature. If you want large show guppies you must hold the temperature higher, somewhere in the 80 to 85°F. range. If you want your fish around for a long time and therefore have enough time to do genetic experiments, you should drop the temperature to about 73 to 78°F. There is a happy medium of course, and the best of both temperature ranges can be had by following this line. When the young are born place them in a tank at about 82°F. As the young grow into adults, displaying their full finnage, the breeding fish are selected and put into a tank which is held at about 74°F., which will prolong their life and keep them going for many, many months. The fish which are selected for show work are held at the higher temperature (73°F) and are kept on a feeding program such that maximum size and condition is obtained quickly. This generally causes a show fish to be past it's prime in about 14 to 16 months. This is the price you pay for large quickly grown fish. It is very important that you keep in mind the breeders and be careful in your selection of both male and female. Select only fully matured fish, because it is only in the adult that one can truly see what their genetics is displaying. How often is the comment "the best looking fish I have always seem to be found in my tank of culls". This statement tells us that these people are culling at too early an age, and therefore not getting the most out of the selection of breeders, as well as show stock in some cases.

I have started to do some work on this problem of temperature and have started a series of tests by asking one question: will a male guppy from a given strain grow to the same size and shape if it is raised at a lower temperature than it's brother at a higher temperature, or is the only way to obtain maximum size and shape closely tied to high temperature at all times? So far I have tested only four strains and the results are about the same in each case. The fish raised at the lower temperature reach about the same size as their brothers who were raised at high temperature. I say almost because the fish when compared directly by measuring are slightly different. In the most drastic case, a blue widetail strain, the length of the overall fish was 4.5mm longer in the fish at higher temperature. The average difference in total length was only 2mm. The blue widetail that was 4.5mm longer than his brothers looked like a giant and it was very easy to see a difference of even 1.5mm length. But I will do many more of these tests, before I can arrive at any solid answers to my original question. The fish raised at the higher temperature (85°F.) grew the fastest, and were all dead in about 10 months. The fish grown at a lower temperature (74°F) were found to be growing slowly but surely all along the way. While they have not totally caught up with their brothers at higher temperatures, they are still alive at 36 months and still growing slowly. Who knows, if they live

long enough they may catch up. But as I say there are more strains to be tested before we can make any firm statements.

Here is a composite graph of many different strains that will show you the importance of temperature and how all the other factors fall into the temperature complex. Study it awhile and you will see many interesting points that might be of help.



Now for the very high temperature factor I mentioned earlier. When guppies are kept at 110°F. they can be maintained with a little care, and when the young are born one will find a higher rate of mutation. The higher the temperature, the higher the mutation rate. If you want to experiment, here is a very easy one to explore. The results are mostly unsatisfactory as is the case with most mutations, but once in awhile a good new form may come along, and who knows, you might just obtain a truly spectacular guppy. As the young fish are born at this high temperature, place them in a different tank where the temperature can be lowered a few degrees a day until you get them to 74°F for a growing range. The parents must be kept at the higher temperature all of the time as it is their bodies at the time of cell division that the changes occur. They will not live long and you must feed with great care. They will need more food and it is very easy to foul the water at this high temperature. As you are working in this kind of experiment, remember to make all temperature changes, when necessary, very slowly both up and down. If you have a few extra tanks and would like to do some work along this line, be sure to keep complete records. Your notes will be of great importance and the records will be invaluable. (reprinted from the "Guppy Pond", May 1972)

GUPPY ROUNDTABLE SEPTEMBER 1972

